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Three-phase Transmission Plant of the Chicago Edison Company.

In the year just closed one of the most significant and important developments in electrical engineering has been the increase in the use of multiphase alternating-current transmission in combination with direct-current distribution in central-station systems and the consequent employment of rotary transformers. An instructive example of this is furnished by the recent installation of a three-phase transmission plant in and connecting the Harrison street and Twenty-seventh street stations of the Chicago Edison company.

The idea of the scheme of transmission of electrical energy adopted by the Chicago Edison company is to concentrate the steam generating plant for the entire city of Chicago and its suburbs in its two downtown stations, which are located on the river front at Harrison street and Washington street, abandoning the generation of steam in its other central stations, which are placed at Twenty-seventh street and Wabash avenue for the southern residence district, and at Oak and Clark streets for the northern residence portion of the city. The same method would naturally be employed in connection with other outlying territory which may hereafter be supplied by the company.

The method which is now in use for transmitting energy from the Harrison street station to the Twenty-seventh street station is not the permanent method which the company hopes to carry out, but is one which is used temporarily for shutting down the Twenty-seventh street station as a steam plant for a period of 18 hours each day. Ultimately, it is the intention to install at Harrison street either three-phase generators of the revolving-field type which will generate alternating current at 4,000 volts, or to use special generators which will be able to give out three-phase alternating current and direct current at the same time in any proportions desired up to the stated capacity of the machines. In case the latter machines are used their direct-current sides will feed into the main bus-bars of the station, their alternating-current sides being connected to step-up transformers feeding the various transmission lines, the transformers being wound for the desired voltage on the lines. It is probable that the company will use the straight three-phase generators for the greater portion of this work, and will use the combination machines for the day load of the various sub-stations, the object of the combination idea being to keep the generators full loaded at all times during which they operate. The combination generators will furnish whatever alternating current is necessary for the transmission lines, and the balance of their capacity will be utilized by feeding direct current into the main direct-current bus-bars of the station, thus keeping the generators full loaded at all times during which they operate.

A fair idea of the transmission plant now in operation may be obtained from the pictures on this and the following pages. Fig. 1 is a view in the Harrison street station, with the rotary transformer in the foreground. Back of it is the big general gallery switchboard, while the special stationary transformer board is shown below. Fig 2. gives an enlarged view of the rotary transformer at Harrison street, showing both direct and alternating-current sides. The stationary transformers and the special switchboard at Harrison street are shown in Fig 3, while the panel of the general board at this station

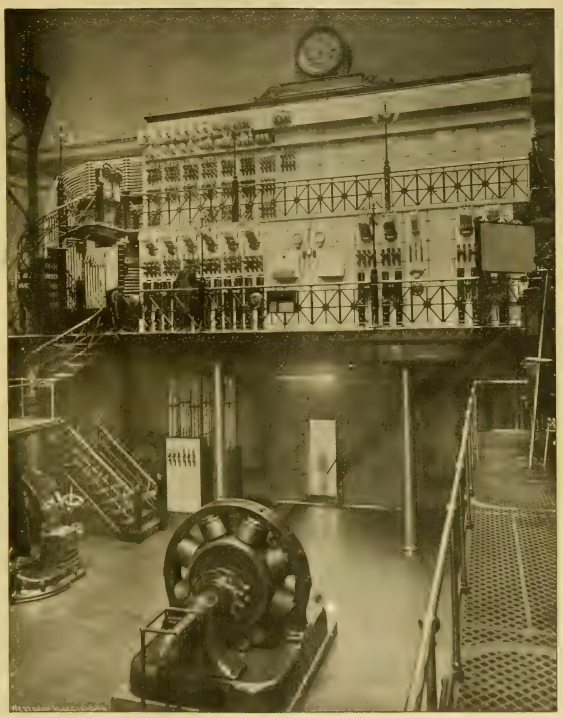

FIG. 1. THREE-PHASE TRANSMISSION PLANT OF THE CHICAGO EDISON COMPANY.—VIEW IN HARRISON STREET STATION, SHOWING ROTARY TRANSFORMER.

devoted to the alternating work is shown in Fig. 4. The remaining pictures represent the plant at the other end of the line. Fig. 5 shows the stationary transformers and special switchboard at Twenty-seventh street, while Fig. 6 shows the two rotaries that are here in use, and Fig. 7 is a diagram of a characteristic load curve at this station.

In the Harrison street station is now installed the 250 kilowatt rotary transformer shown in Figs. 1 and 2. This machine is called a converse rotary, since it converts direct current to alternating current instead of alternating to direct, as is the usual custom. The direct-current side is connected to the positive and negative bus-bars of the three-wire system feeding the downtown district of the city. The direct current is taken through the rotary at from 230 to 290 volts, according to the pressure on the bus-bars in the station. The current is changed while passing through the machine to three-phase alternating current at from 138 to 174 volts, according to the pressure on the direct-current bus-bars. The machine has eight poles and operates at 375 revolutions per minute, giving three-phase current at 25 cycles. The machine is very generous in its proportions and is designed on the same general lines as the direct-current generators of the General Electric company, which manufactured it. A tachometer is belted from the shaft of the rotary and is shown on the base of the machine in Fig. 2. The speed is controlled by means of a resistance box in the field magnet circuit. No device is used for controlling the voltage, the regulating being done at the receiving station.

The indicating and regulating apparatus for the rotary transformer at Harrison street is located on the main regulating switchboard of the station. A Weston illuminated dial, vertical-reading ammeter is installed for the direct-current side of the rotary. Below it are two knife switches, one for the positive and one for the negative side, used to connect the rotary to the direct-current bus-bars. A small switch which is shown between the larger knife switches (on the panel to the right in Fig. 4) is used for shunting the starting box, the multiple contact switch for which is located directly below the knife switches. The circular multiple contact switch at the bottom of the panel controls the resistance box for the fields of the rotary. The starting up of the rotary is effected by means of a starting box in the direct current side, in the same manner as a direct current motor.

From the alternating side of this large rotary transformer the current is taken to the low-pressure side of six step-up transformers, which raise the pressure to about 2,300 volts. These transformers and the switchboard for them are shown in Fig. 3. The energy is then transmitted to the Twenty-seventh street station, a distance of 3¼ miles, by means of a No. 00 B. & S. three-conductor twisted paper-insulated, lead-encased and jute-wound cable, which is drawn into the duct system between the two stations at Twenty-seventh street the transmission line connects with a set of step-down transformers (Fig. 5), which reduces the pressure from the line voltage to about 75 volts. The current then passes through two induction regulators, which have a range of 15 per cent. The induction regulators are connected to the alternating side of the rotary transformers of this station (Fig. 6), one regulator being used for each rotary transformer. The current, after passing though the rotary, is changed from three-phase alternating current to direct current of from 115 to 125 volts potential, according to the pressure required on each side of the direct-current three-wire bus-bar in the station.

Each rotary is provided with a starting box so that it may be started from the direct-current bus-bars of the station in a manner similar to that of a

direct-current motor. When the rotaries are running at their proper speed and are in phase with the transmission line, as shown by the incandescent-lamp phase indicator, the switches on the alternating-current side of the rotaries are closed and they then begin to take current from the transmission line to deliver to the direct-current bus-bars feeding the four o'clock and operates until 12 o'clock, when it is again shut down. During the period of this operation the load is so divided that the engines operating the station run as nearly as possible at full load, the balance of the load being taken by the rotaries in much the same way as a storage battery would act if installed in the station itself. The work

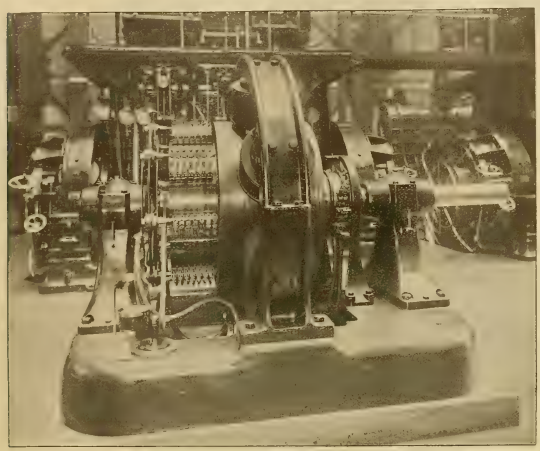

FIG. 2. THREE-PHASE TRANSMISSION PLANT OF THE CHICAGO EDISON COMPANY.—ROTARY TRANSFORMER AT THE HARRISON STREET STATION.

underground network. Each rotary transformer is provided with an ammeter for its alternating-current side and also for its direct-current side, also a resistance box in the shunt magnet circuit.

The load taken by each rotary is regulated by means of the induction regulator, which controls the voltage impressed upon each rotary. By increasing the voltage impressed the rotary is made to take a greater load, and by diminishing the voltage the load is reduced. Each stationary transformer is provided with a high-pressure three-break switch, which is operated by means of a rack and pinion, as shown in Fig. 5.

The stationary transformers and induction regulators are mounted on a marble floor, which is raised above the main floor of the dynamo room, as shown in Fig. 5, the space between the two floors forming an air chamber into which air is blown by means of an electrically driven blower, thus affording an air blast for keeping the transformers and induction regulators cool.

The indicating, regulating and switching apparatus for the rotary transformers is shown on the switchboard shown in Fig 6. The direct-current ammeters are mounted on the upper portion of the right-hand panel with the phase lamps between them. The knife switches for the direct-current side of the rotaries are directly beneath the direct-current ammeters, and the field regulating switches, each of the vertical multiple contact pattern, are seen immediately below. The switches for the alternating-current side of each rotary are at the bottom of the board. The rotaries may be started also from the alternating-current side if desired, but [illegible] started from the direct-current side. [illegible] put on the system before the direct-current dynamos are taken off. The direct-current side of the pair of rotaries are connected [illegible] exactly similar to direct-current dynamos [illegible] three-wire system, the connection [illegible] to the switchboard, and by means of the [illegible] each rotary may be connected to either the positive or negative side of the system at will.

The [illegible] are provided with [illegible]. The machines have [illegible] speed of 750 revolutions [illegible]

The load [illegible] indicate the operation of the [illegible] and how the power [illegible] It will be [illegible] switchgear must be [illegible] the rotary load between [illegible] cent. [illegible] from the [illegible] up to [illegible] the direct [illegible] are out of the [illegible] per cent. [illegible] to Harrison [illegible] end of the [illegible] Twenty-seventh street [illegible]

done by the engines is shown by the dotted curve. The work done by the rotary transformers is shown by the lower full line, the upper full line representing the sum of the engine load and the rotary load and being the total current supplied to the underground system.

It will be seen from the curve that the steam plant of the Twenty-seventh street station is operated under the best possible economy, since it is operated at full load, and as it is operated only from dusk until midnight, only one shift of

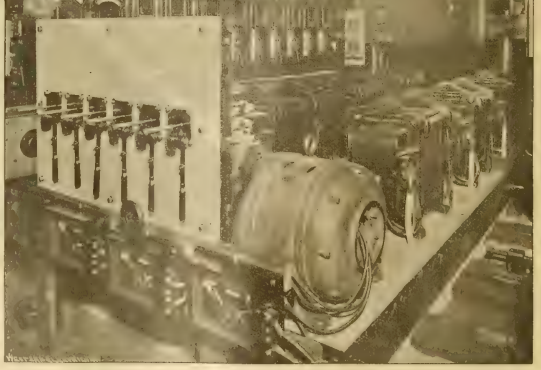

FIG. 5. THREE-PHASE TRANSMISSION PLANT OF THE CHICAGO EDISON COMPANY.—STATIONARY TRANSFORMERS, INDUCTION REGULATORS AND TRANSFORMER SWITCHBOARD AT THE TWENTY-SEVENTH STREET STATION.

[illegible] required, and during the balance of the [illegible] of the day all the energy comes from Harrison street station, and but one man is required in the Twenty-seventh street station, whose duties are to look after the operation of the rotaries. With the present method of operation a large saving is effected in coal and other operating material, since the energy is generated by the Harrison street station, where the greatest economy is found. The saving in labor is also very great, as only one shift of firemen, engineers and oilers is required.

The success of this original installation has been so marked, both from its satisfactory operation and from the great economies which have been effected, that the company intends to increase the capacity in rotary transformers to take care of the entire load of the Twenty-seventh street station, doing away entirely with the generation of steam at that point. The plans for this accomplishment have been completed for some time. It is possible that the company may install a small storage battery in the Twenty-seventh street station to operate in connection with the rotary transformers, but this question has not been definitely decided.

This transmission system has been in operation since October 13th, and up to date no difficulty of any kind has been experienced, all the apparatus fulfilling the expectations of everyone interested. From the reading of the large direct-current wattmeters, which are installed both at Harrison street and Twenty-seventh street, the input and output of the transmission system is determined daily and records are carefully kept. By the use of these wattmeters all of the losses, of whatever nature, are accounted for, and from the records of the month of December the total loss of energy in the entire transmission system was 26.4 per cent., including all the loss in the converse rotary at Harrison street, step-up transformers, line transmission, step-down transformers, induction regulators and the rotary transformers at the receiving station. The ratio between the average load and the maximum load of the transmission system for the entire month was 42.8 per cent., which shows a remarkable economy under such conditions.

Before closing the account of this interesting installation the fact should be mentioned that the orders for the apparatus embraced in it were placed with the General Electric company as early as May, 1896, the erection of the plant being deferred owing to the uncertain financial conditions of last year which are so well known to all. There seems to be no question that Mr. L. A. Ferguson, general superintendent of the Chicago Edison company, was the first to suggest the use of multiphase-current transmission and rotary transformers in connection with the direct-current distribution systems of Edison three-wire central stations. Indeed it is true that the subject was seriously considered in Chicago in the spring of 1895, at a time when the use of the alternating-current transmission in connection with Edison stations was considered a startling innovation very unlikely of accomplishment. Mr. Ferguson has given deep thought to the problem, with results which are certainly most gratifying.

Chicago Engineers' Club.

There will be a meeting of the Engineers' Club of Chicago, at 1800 Fisher building, on the evening of January 7, 1898, at 8 p. m. sharp, to listen to Edward B. Ellicott, the city electrician, on fire alarm systems. Members of the club and their friends will visit the Chicago City Railway company's power plant at Forty-ninth street and Oakley avenue, leaving clubrooms at 1:30 p. m.

Rapid Transit in New York.[1]

By Matthew Marshall.

The distinguishing feature of last week's stock market was the sustained rise in Manhattan Elevated, Third Avenue and Metropolitan Street Railway, resulting from the decision of the Supreme Court not to approve the scheme submitted to it for an underground rapid transit railroad, except upon conditions practically impossible of fulfillment. The court requires a stipulation from the Rapid Transit Commission that the bond to be given by the contractors for the building and operation of the pro-

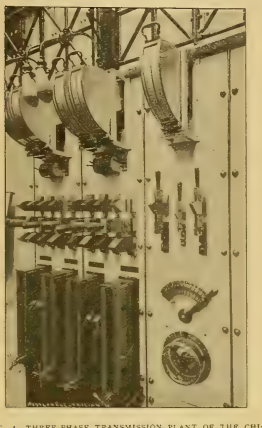

FIG. 4. THREE-PHASE TRANSMISSION PLANT OF THE CHICAGO EDISON COMPANY.—PANEL OF GENERAL SWITCHBOARD AT THE HARRISON STREET STATION FOR ROTARY TRANSFORMER.

posed road shall be in the penalty of not less than $15,000,000. Such a bond, the commissioners say, and it is generally conceded, cannot be obtained. Moreover, the court intimated that the building of the road would cause an increase of the city's debt beyond the constitutional limit of 10 per cent. of the assessed value of its taxable real estate, although it left that point to be determined by the Court of Appeals in another suit or suits, there being no right of appeal to that court in the pending proceedings. An effort will be made to persuade the Supreme Court to recede from its requirement of a $15,000,000 bond, but its success is doubtful, and, in any event, the question of the debt limit is likely to prove an insuperable bar to the execution of the scheme. Then, too, the incoming mayor and comptroller are unfriendly to it, and as they will become on January 1st, official members of the Board of Rapid Transit Commissioners, they may be expected to delay its progress, even if all other obstacles to it shall be removed. Hence, the prospect is, that the existing elevated and street surface railroads will have no competition to contend with for many years.

The history of rapid transit in this city is one of successive efforts and defeats. The project had its inception in the fertile brain of the Hon. Abram S. Hewitt, who, in January, 1688, when he was mayor of the city, sent a message to the Board of Aldermen outlining a plan for a railroad from the city hall northward, partly underground, partly in an open cutting and partly on the surface of the street or above it, to be built by the city and leased by it for a term of years at a rental which would eventually reimburse its cost and leave it the property of the city, very much in the same way as is now proposed. Mr Hewitt's road was to begin under the Harlem railroad at Fifty-fourth street, and run thence under the Harlem railroad, the New York Central railroad station, the present Murray Hill tunnel and Fourth avenue to the head of Lafayette place. There it was to pass in an open cutting, through Lafayette place and Elm street, as widened, to the city hall. His plan also contemplated several branch and extension tunnels and surface or elevated roads, to accommodate the portions of the city off the main line. The cost of constructing the line from Forty-second street to the city hall Mr. Hewitt estimated at $10,000,000, which, he proposed, should be raised by the city by selling three per cent. bonds, and his idea was that the New York Central Railroad company should take a 99 years' lease of that line at an annual rental of five per cent. on the bonds issued to pay for it. This would meet the three per cent. interest on the bonds and leave two per cent. for a sinking fund to extinguish the principal, the city thus owning the road at the end of the lease free of debt.

Mayor Hewitt's plan was not favorably received, principally, it would seem, because it was thought to be intended to benefit the Vanderbilt family, who then owned largely of the stock of the New York Central Railroad company. Still, his suggestion was so valuable, and the clamor for improvement in the means of transportation between the upper and the lower parts of the city was so loud, that in 1891, or three years later, the Legislature passed a rapid transit act, under which, with amendments, all the subsequent proceedings for securing rapid transit in this city have been had. The first scheme concocted by the commissioners appointed under the act was comprehensive and ambitious. It embraced a system of costly underground roads to be constructed by private capital under a franchise for 999 years. This franchise, after a great deal of preliminary discussion and advertising, was offered for sale at public auction in December, 1892, but the only bid for it was one of $1,000, which the commissioners refused to accept.

Negotiations were then begun with the Manhattan Elevated Railway company for extensions and additions to its lines intended to increase their carrying capacity, and for a little while they promised to be successful. The political party in control of the city government favored the Manhattan company, and in view of the increased profits it was going to make, they invested largely in its stock. The public followed their lead, and during the first four months of 1893 put the price of the stock up very much as they are putting it up now. Then came the panic of 1893, and the Manhattan directors, thinking it was not a propitious time to make the necessary expenditures, abandoned the scheme for enlarging their system.

Recourse was, therefore, again had to the Legislature, and in 1894 the Rapid Transit act was amended by the addition of provisions for submitting to a vote of the citizens of New York the question whether or not the city should not construct the required road itself, and lease it, on a plan similar to that suggested by Mr. Hewitt. The vote was taken in November, 1894, and the proposed municipal construction of the road was approved by a substantial majority. The commissioners under the act thereupon set to work and laid out an underground railroad which was to cost, by their own estimate, $50,000,000, and by that of expert engineers $70,000,000. Failing to obtain the needful consents of a majority of the abutting property owners to the construction of the road, they applied to the Supreme Court for the approval which, under the act, would have been a substitute for the consent of the property owners, but this the court, in May, 1896, refused, basing their refusal upon the ground that the estimated cost of the work was beyond the city's ability to pay without exceeding its constitutional debt limit.

The commissioners then revised their plans, and, by changing the route of the proposed road from Broadway to Elm street and simplifying its construction, they reduced its estimated cost to $35,000,000. This new scheme, having also failed to receive the needed approval of the property holders affected by it, was submitted to the Supreme Court, and has just been practically condemned by them in the manner already described. The commissioners are now engaged, it is announced, in preparing arguments to show that the exaction of a $15,000,000 bond from the contractor for the work is unreasonable; but, if they succeed in persuading the court to withdraw its requirements of a stipulation to exact such a bond, they have still to meet the question of the probable infringement of the city's debt limit.

According to the accounts which have been printed in the newspapers of the views which the commissioners and their legal advisers take of the nature and amount of the bond to be required of the contractor or contractors for building the proposed road, the question whether or not the operation of it would be profitable after it was completed has never seriously been considered by them; but they have assumed, as a matter of course, that its net earnings, over and above running expenses, would be amply sufficient to pay the minimum rental fixed by the Rapid Transit act. That minimum is the interest on the bonds issued by the city to pay for the work and one per cent. annually on the principal for a sinking fund. Assuming the cost to be no more than $35,000,000, and the annual interest but three per cent., the annual rental would be four per cent. on $35,000,000, or $1,400,000. Should the cost be $50,000,000 and the interest 3½ per cent. the rental would rise to $2,250,000. That the road would earn even the larger of the two amounts seems never to have been doubted by the commissioners, and their sole anxiety has been to secure the city against loss by the failure of the

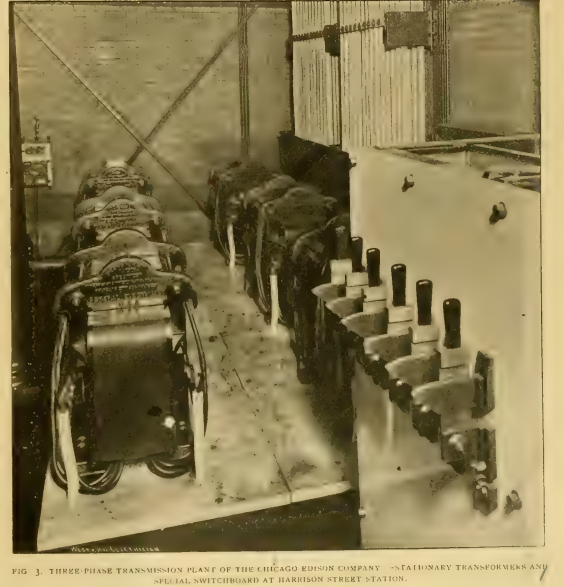

FIG. 3. THREE-PHASE TRANSMISSION PLANT OF THE CHICAGO EDISON COMPANY.—STATIONARY TRANSFORMERS AND SPECIAL SWITCHBOARD AT HARRISON STREET STATION.

contractor to carry out his contract for its construction. Although the act requires them to take a bond for the payment of the rental as well as for the construction of the road, they have apparently intended to take only a small bond to secure the rental. In this respect they have exhibited a laxity common to many business men in like circumstances. When the West Shore railway, for example, was projected, nobody doubted that it would earn the interest on the bonds issued to construct it. It ran parallel to the New York Central railroad, and if it got only one-third as much business as the Central did, it was computed that it would be able to pay its interest and have a handsome surplus. So the Rapid Transit commission

1 From the New York Sun, December 27, 1897.

ers have concluded that since the elevated and the surface railroads running parallel with their proposed road earn large amounts, their road will earn at least $2,250,000, and more besides. The West Shore railway, as a matter of fact, went into a receiver's hands almost immediately after it was finished, and the receiver, finding that he could not make it earn even its operating expenses, was on the point of applying to the court for permission to discontinue operating it altogether, when Jupiter Morgan intervened and majestically compelled the

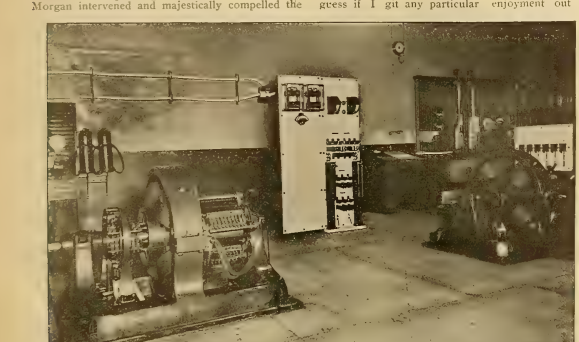

FIG. 6. THREE PHASE TRANSMISSION PLANT OF THE CHICAGO EDISON COMPANY.—ROTARY TRANSFORMERS AND CONTROLLING SWITCHBOARD AT THE TWENTY-SEVENTH STREET STATION.

New York Central to take a lease of the road at a rental of 2½ per cent. on its bonds. The Nickel Plate road disappointed its projectors nearly as much, and was saved only by a lucky negotiation with the late William H. Vanderbilt. Like disparities between promise and performance have been exhibited by the Manchester ship canal, the Isthmus of Corinth canal and the new North German canal, and every investor has to suffer them occasionally.

Prudent men in any enterprise always look the worst in the face and prepare for it. The Rapid Transit commissioners will not be prudent if they do not guard against the possibility of loss by the the city in the operation of their proposed road as well as against loss in its construction. The contractor for the construction must, by the terms of section 34 of the act, agree to pay a rental of not less than $1,400,000 a year for 35 years, and he may have to agree to pay one of $2,250,000 a year for 50 years. In the former case his total liability will be $49,000,000; in the latter it will be $112,500,000. How much security ought to be required for the payment to the city of even the smaller of these sums it is for the commissioners to consider, but nature consolation is likely to convince them rather that a $15,000,000 bond is not enough than that it is too much. They must remember that, if the road fail to earn its rental in the hands of a contractor, it will do the same when the city takes possession of it. The contingency must therefore be provided for of a total failure of the scheme, and the possible loss by it must be assumed by the contractor and his bondsmen and not by the city

Earnings of Minnesota Telephone Companies.

In compliance with the requirements of the state law providing for the assessment of three per cent. upon the gross earnings of telephone companies in Minnesota, the corporations operating exchanges have already made report.

The Northwestern Telephone company has not been able to make its total statement, as it has not yet tabulated the returns made by the 150 stations which it controls. The returns for eleven months, however, show the gross earnings to be $375,000.

The figures given out thus far show the following earnings of the local exchanges in the towns named: Duluth, $75,000; Winona, $9,127.97; Crookston, $2,079.44; Red Wing, $2,523.25; Albert Lea, $1,454.40; Pipestone, $427.50. Fifteen companies have yet to file their report.

Bell Practice Unappreciated.

The Louisville Courier-Journal relates an incident that shows that the telephone is not without its disadvantages. The trouble occurred on one of the new Preston Park and Eighteenth Street electric cars between a colored man and a countryman from Indiana. The countryman boarded the car at Seventh and Main street. The car collected his fare and took a position on the rear platform.

The man from the country soon discovered a small button at the side of the seat, which he proceeded to press. The car stopped, but the farmer signified no intention of getting off. He laughed heartily when the car started, and again began to ring the electric bell.

"Don't you know you are not allowed to ring that bell unless you want the car stopped?" asked the conductor in a gruff voice.

"I paid my fare," answered the other, "and I guess if I git any particular enjoyment out of ringin' yer old bell you haven't got any right to stop me."

With this the troublesome passenger pressed two buttons to show that he was not to be outdone. The conductor then seized him by the nape of the neck and ejected him from the car.

"This beats any town I ever did see," said the farmer. "They talk about havin' new cars fer comfort. I never did see one of them bells, and I just wanted to practice on them a little. That's what a feller gits, though, when he does try to improve himself and act like city folks."

The Telephone in Kentucky.

A green-looking man came to town the other day with a small bucket of very white butter to sell and called on Will Matthis to buy it, says the Elizabethtown News. Mr. Matthis said he didn't want any at the store, but he would inquire if his wife wanted any. So he stepped to the telephone, called her up, and talked for a few seconds through the instrument. Then, turning to the countryman, who was standing with his hands in his pockets, his eyes dilated and his face very red, he told him that his wife said that she would not need any butter. The indignant countryman blurted out:

"Look here, mister, if you didn't want any butter why didn't you say so? I ain't such a fool as to think that you've got your wife in that little box!"

Mr. and Mrs. J. visited town the other day, according to the Louisville Dispatch. The madam is a large, muscular-looking woman, and is evidently the boss of the ranch, while Mr. J. is a cowed, effeminate-looking creature who seems to be afraid when the madam is around. While Mrs. J. went into Goldnamer's to do some shopping the little man slipped off to Bell's to get a drink. While he was down there he heard the telephone ring, and inquired what it was. The mysteries of the instrument were explained, and Mr. Bell offered to call up his wife at Goldnamer's and let him talk to her. This seemed to please him very much, but just as he got the trumpet to his ear the lightning struck the wire and knocked him down. Staggering to his feet he said, "That's her; it sounds just like her."

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

J. B. Green has been soliciting subscribers for a telephone exchange in Cambridge, Iowa, and thinks that enough will be secured to justify putting in a system.

The Portage Telephone company is an applicant for a telephone franchise at Janesville, Wis.

M. W. Krueger and M. E. Barnett of Neenah, Wis., have secured a judgment against the Wisconsin Telephone company for damages for placing a telephone pole in front of their store.

The local telephone exchange at Ortonville, Minn., has been reorganized under the name of the Inter-State Telephone company. It connects with the long-distance wires of the Dakota Central Telephone company of Aberdeen.

E. M. Walsh of Crookston, Minn., proposes to form a stock company to construct a telephone system connecting Crookston with Fosston, McIntosh, Red Lake Falls, Thief River Falls, St. Hilaire, Minn., and Grand Forks, N. D. The system is to be ready for use in the early part of next summer.

The Armell and Dog Creek Telephone company will construct a line from Lewistown, Mont., to Wm. Fergus' ranch, 30 miles, with a branch line 22 miles long to the W. H. Fergus ranch.

In the case against the telephone company at Viroqua, Wis., by Baglein, for damages for loss by fire, alleged to have started because of imperfect insulation of the telephone wires, the jury gave judgment for $1,300, but in answering questions in the special verdict gave one answer that practically nullifies the finding, and the court may set it aside.

The Rocky Mountain Bell Telephone company will extend its system from Cascade to Choteau via Sun River and Augusta next season.

The subscribers of the Wisconsin Valley Telephone company of Whitehall, Wis., complain that the company is not using copper wire, and there is also considerable objection to the way its poles are set along country roads. This company is rapidly pushing work on its lines and is arranging to connect over 150 towns and cities in western and northwestern Wisconsin. The telephone sys-

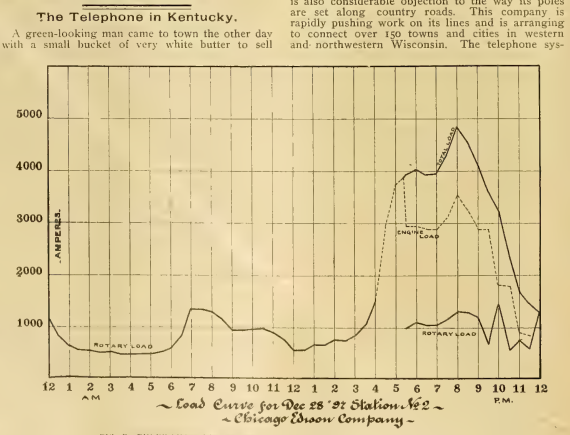

FIG. 7. THREE PHASE TRANSMISSION PLANT OF THE CHICAGO EDISON COMPANY.

tem to be used by this company has been tested at Chippewa Falls and found to be very satisfactory.

The Monad Telephone company has placed a transfer system on its switchboard in Des Moines, which reduces the difficulties of operation considerably.

A telephone line has been completed between Lamoni and Andover, Iowa.

A telephone line is being constructed between Columbia and Chariton, Iowa.

A telephone war is on at Great Falls, Mont. The Electric City Telephone company is a new insti-

tution which has made a rate of $48 for telephones. The Rocky Mountain Bell Telephone company has now made rates of $35 for business and $12 for residence service.

The Indianola Mutual Telephone company of Indianola, Iowa, has been incorporated with $1,200 capital stock.

The Wisconsin Telephone company announces a reduction on long-distance instruments at Marinette, Wis., to take effect January 1st. A single-wire service is reduced from $60 to $50 for business offices and from $42 to $36 for residences.

The Mississippi Valley Telephone company announces that the refusal of the Ft. Madison, Iowa, council to allow its wires to pass through that place will not prevent the building of the line to Keokuk. The wires will simply go around Ft. Madison, and the latter will not have the benefit of telephone connection.

New Heilmann Electric Locomotive.

Nearly four years ago the initial locomotive of J. J. Heilmann, the "Fusée Electrique," made the trip between Paris and Nantes, with a train of 200 tons, and attained a speed of 110 kilometers per hour.

From that time until quite recently the world at large has heard little of the inventor or his work. On November 12th, however, the second engine of this type, the "Heilmann 8001" (these figures denoting number 1 of the new series of eight-wheel trucks) commenced a series of trial trips from Paris over the tracks of the Compagnie de l'Ouest, whose constructing engineers supervised the building of the new locomotive.

The Fusée Electrique was defective in many particulars, and in the present machine the inventor has endeavored to avoid or correct these faults. In making changes duplicates of the several parts assumed to be improvements were built, one of which was incorporated with the old and its fellow reserved for the new machine, in case it proved successful. This form of cut-and-try experimenting has occupied much time, and accounts in part for the almost omnious silence which has been maintained on the subject of the Heilmann invention. This method of procedure, while laborious and snail-like in its progress, had the advantage of bringing out two complete and similar machines at the same time.

An improvement of much importance has been the placing of the trucks nearer the extremities of the machine, which gives it a much lighter appearance than the first, which was very markedly clumsy and stubbed. The changes made have had for their aim:

First—The increase of the total power of the machine, and hence the specific power, while the limit of 15 tons weight over each axle, or a total of 120 tons, is maintained.

Second—To improve the method of hanging the motors. In the first locomotive the motors were placed direct on the axles, with elastic rings of "woodite." These heated badly and metal was substituted; then the shocks of metal against metal were prejudicial to perfect action in the brush contacts.)

Third—Changing the cylinders from a horizontal position, and making their action nearer uniform.

Fourth—Improving the apparatus of the switchboard as suggested by experience.

There is also an improvement in the boiler arrangement, as comparison will show. While the first engine was much heavier its capacity of evaporation was 9,000 to 10,000 liters of water per hour, against 13,500 for the new.

The boiler dimensions are: Grate surface, 3.34 square meters; furnace surface, 16.47 square meters; tube surface, 169 square meters; total heating surface, 185.47 square meters. The number of tubes is 351. The exterior diameter of tubes is 0.045 meter and the length between plates is 3.80 meters. The smokestack summit is 4.20 meters above the rails, and is at the rear of the machine. Nevertheless this can be used as a "doubleender" locomotive, although it is claimed there is less resistance offered to the wind when running with the stack in the rear. Two large water tanks, with a capacity of seven tons, measuring 0.50 by 1.10 by 0.20 meters at the base and 4.90 at the top, lie alongside the boilers, and a couple of coal bins, with a capacity of 4.5 tons, are also placed close by. The water is fed to the boilers by a Friedmann injector.

That portion of the locomotive ahead of the water and coal receptacles, having an outside dimension of 2.70 meters, forms with its sheet-iron shell a closed engine and dynamo room 7.40 meters long, 2.55 wide and 2.40 high. This space is occupied by the two electric generators and one engine, with passageways on either side the machinery, leading to all points requiring the presence of the engineer.

The engine is composed of two symmetrical groups formed each of three tandem cylinders, set at a variance of 120°. The whole constitutes a sort of block, 3.50 meters long, 1.50 wide, and 2.40 high. The high-pressure cylinders are 300 millimeters in diameter. The low-pressure cylinders, below the former, are 480 millimeters in diameter. The six cranks and piston rods are enclosed, and all oiling is done automatically.

To prevent strain and pounding from the vertical thrust of these pistons the most perfect balancing has been found necessary, and has been perfectly accomplished by the broken vibratory action of the special piston thrust.

The compound engines have 1,450 indicated horse power, and are of the Willans type. A Westinghouse brake pump forms part of the steam equipment. The engine is directly connected to two identical generators, with hexagonal fields about 1.60 meters diameter by 0.80 in length, made in separable halves.

The revolving toothed armature has 1.05 meters exterior diameter, is drum wound, and has six carbon brushes.

The two dynamos are run at 400 revolutions per minute, furnishing 920 amperes at 450 to 500 volts—a total of 1,200 horse power. A small four-pole dynamo plays the part of exciter.

The current developed by the two dynamos actu-

J. J. HEILMANN.

ates eight motors mounted on the eight axles of the locomotive. These are so arranged as to thoroughly follow every motion of the trucks without interfering with their action and usefulness.

Variations of speed are accomplished by varying the current from the exciter. Proper appliances for accomplishing this result, as well as apparatus for reversing, etc., are grouped on a compact switchboard under the hand of the electrician. During the trial trips between Nantes and Paris, with an excursion party of 60 engineers, representatives of the press, and the like, experiments were made and every requirement suggested was promptly and perfectly met by successful accomplishment.

The foregoing sketch and the accompanying illustration and portrait of the inventor, J. J. Heilmann, is from l'Energie Electrique.

Electrical Development in Canada.

[From the Ottawa correspondent of the Western Electrician.]

Electricity was first used as a motive power, in Canada, in 1883, at the Toronto Industrial Fair. Three of this city's electric street railway cars were equipped with electric stoves in February, 1892. It is also to be noted that the first electrically cooked banquet was provided in Ottawa in 1892. Electric mail cars, too, were first used in Ottawa, November 9, 1893.

In 1896 there were 30 railways in Canada, the motive power of which was electricity, with 569 miles of railway and an equipment of 947 motor cars, 360 trailers, 62 sweepers and 1,315 motors. The number of miles run during the year was 22,772,631, and the number of passengers carried was 73,972,414.

NEW HEILMANN ELECTRIC LOCOMOTIVE.

The following year, 1884, produced the first practicable electric railroad. The current was taken from copper dips laid in a wooden box between the rails. In 1885 the track was lengthened, and the overhead wire and trolley arm used.

The first city in Canada and in the world to have established in it a special electrical heating service from a central station, was the city of Ottawa, Ont Blarcom a deed of trust on the whole business to secure the issue of $4,000,000 in bonds to be applied as directed by the meeting of stockholders held December 11, 1897.

The electric light plant of the Hartford Electric company at Hartford, Wis., is in running order

Northwestern Electrical Association.

An invitation is extended to electrical men generally to attend the sixth annual convention of the Northwestern Electrical association at the Hotel Pfister, Milwaukee, commencing on Wednesday morning, January 19th. The entertainment committee announces that arrangements have been made with the new management of the Pfister which will insure satisfaction to members and visitors. Direct and alternating current will be provided for exhibits.

One and one-third railroad rate can be secured, conditioned upon 100 certificates of attendance. Frank L. Perry, 510 Marquette building, Chicago, will have charge of the transportation of delegates from Chicago.

The following list of papers has been prepared:

"Practice of Theory," by John C. McMynn of Chicago.

"Present Efficiency of Incandescent Lamps," by John E. Randall of St. Louis.

"Notes on Municipal Ownership," by Fred De-Land of Chicago.

"Physical and Chemical Properties of Volatile Oils in Boilers," by William H. Edgar of Chicago.

"Electric Lighting for Profit," by Alex Dow of Detroit.

"Long-distance Transmission," by Axel Ekstrom of New York.

"Transformers," by E. H. Abadie of St. Louis.

As usual, the programme provides for the entertainment of membesrs and friends during the convention.

Consolidation of St. Louis Lighting Companies.

Papers of consolidation were filed at St. Louis December 27th by the Missouri Electric Light and Power company and the Edison Electric company. First, the Knickerbocker Trust company, as trustee, under a deed of August 1, 1893, sold to A. D. Brown for $914,000 all the property of the Edison Illuminating company, conveyed by the original deed, securing the first issue of $4,000,000 gold bonds of the company. Then the Missouri Electric Light and Power company deeded all its property, stock and belongings to A. D. Brown for $100, subject to two deeds of trust aggregating $1,100,000. In a third deed A. D. Brown and wife deed to the Missouri Edison Electric company for $4,000,000 all the property turned over to Brown by the Missouri Electric Light and Power company deed. The new company gives to the Knickerbocker company and J. C. Van

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN — **the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 20,000.

State of Illinois, County of Cook—ss:

Thomas Jansen, being duly sworn, deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the foreman of the printing department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the printing of No. 24 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were printed by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified. And further this affiant sayeth not.

THOMAS JANSEN.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES, Notary Public.

Four Years' Record of Electric Light Convention Advertising.

Issue	Number of Advertising Pages.	Whole Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895	52	68	5,593
May 9, 1896......	72	88	7,575
June 12, 1897.....	80	100	8,643

No other electrical journal has ever equaled this record of 8,643 square inches of genuine full-paid advertising in a single issue.

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The programme for the Milwaukee meeting of the Northwestern Electrical association will be found on another page. It contains promise of a very interesting meeting. The topics to be discussed are matters of importance to the members, and there is no question of the ability or experience of the men selected to read the papers. The committee promises an excellent line of attractions in the way of special features and entertainment.

Two catastrophes that have occupied public attention during the last week are shrouded in mystery, and it seems hardly possible now that exact information regarding the causes of these calamities will ever be obtainable. On Christmas announcement was made of the burning of the Coliseum building in Chicago and the explosion at Jersey City in which two lives were lost, a factory wrecked and many houses damaged. The former was charged to defective electric wiring and the latter to acetylene. The works of the United States Liquefied Acetylene Distributing company, Jersey City, were wrecked by a series of explosions, caused by acetylene gas, and were destroyed by the fire which followed. The immediate cause of the explosion has not been determined. Very little is known about the Coliseum fire which, it should be mentioned, is also attributed to other causes. It is to be hoped that further investigation will be made in both cases, so that responsibility may be fixed.

Preliminary steps have been taken in the formation of an organization of street railway companies of Illinois, and it is expected that a state association will be established on January 5th, when a meeting will be held at the Great Northern Hotel in Chicago. In the proposed reorganization the companies operating street railway lines in the smaller cities and villages throughout the state will co-operate with the Chicago companies in protecting their interests against adverse legislation. The experience of street railway corporations in dealing with the last Legislature has evidently aroused them to a realization of the necessity of united action. It is explained that the new organization will be simply an association for the purpose of taking agressive action in attempting to influence legislation, and to provide a common defense against the passing of laws prejudicial to their interests. It is said that a bill taxing railway companies two per cent. of their gross earnings will soon be introduced in the Legislature, and if it is, the first business of the new alliance will be to fight it.

New York has fondly cherished the hope that some day it would have real rapid transit, but now, it appears, there is no prospect of immediate fulfillment. The plan for the underground railroad from the Battery to the northern end of the island is meeting serious if not fatal difficulties. The Board of Rapid Transit Commissioners, appointed under an act of the Legislature to consider the practicability and cost of the work and to choose a route, completed its report some time ago, in which it was held that the construction of the road was practicable and that the cost would be $30,000,000 to $35,000,000. The board also outlined a route, prepared estimates of the amount of traffic and recommended that the road be built. The court, to which the report was submitted for approval in compliance with the requirements of the law, approved the plans and recommendations of the rapid transit board for the construction of the road, but it held that the contractors should give a bond of $15,000,000 to the city for the faithful performance of their contract. This bond was for constructing the road and operating it for the term fixed in the law and contract. The law provided that the sureties on any bond required of the contractors should qualify in twice the amount of the bond. This would make it necessary for sureties to list property valued at $30,000,000, on which the bond would be a lien for the 35 or 50 year period for which the contractor agreed to operate the road. All this property would be tied up for that time, and, it is claimed, this would work hardship and would be practically prohibitive. It is pointed out, however, that the contractors would not furnish the capital for the construction and equipment of the road, as the city would advance the proceeds of the bonds for this purpose, and that therefore in reality the tying up of the property of sureties would be equivalent only to tying up their capital if they had invested their own money in the work. Another question relates to the limit of the city's debt. Old New York had a wide margin of credit within the debt limitation of 10 per cent. on the assessment, but when it is merged in the greater city it is claimed that there will not be enough margin to permit the new bond issue, as the other municipalities have exceeded their debt limit.

It is feared that failure of the plan now under consideration may discourage the promoters of the project, as the present scheme is the culmination of 10 years' work. The idea was first given definite form by Mayor Hewitt on January 1, 1888, but was not seriously pushed until 1891, and even then very little progress was made. Now, however, after many trials, the plans have been advanced to a point where advocates of the scheme had reason to be hopeful of success, and it will be a sore disappointment if the realization of their expectations is still further postponed.

It has been judicially determined that the position of city electrician of Chicago comes within the scope of the civil-service law, and it is announced that an examination of applicants for that office will be conducted this month under the supervision of the civil-service commissioners.

In the meantime it is said that the electrical bureau may be separated from the fire department and made an independent bureau with a head of its own. Mayor Harrison has read the Supreme Court decision on the civil-service test case, and he believes that an ordinance establishing the new electrical department can be so worded that he may appoint the head of it with the consent of the City Council. The new electrical department has been discussed for some time by city hall officials. The bureau, as it is now organized, is the result of the use of the fire-alarm system and has always been connected with the Fire Department. Since its establishment, however, it has been extended until the superintendent of city telegraphs now has charge of all the wires in the city, the enforcement of the laws pertaining to them, and the superintendency of the municipal lighting stations. The corporation counsel is said to be working now on an ordinance for the establishment of the new department.

Mr. Edison has again freed his mind upon the subject of patents and inventions, but he has added little or nothing to the store of general knowledge. In a newspaper interview the great inventor said that "the value of a patent to an inventor is directly decreased as the value to the public increases. The practice of the United States Circuit Court is such as to drive all the inventors away from revolutionizing inventions into little details." There is marked inconsistency, however, for in another part of the interview Mr. Edison is quoted as saying: "The laws are all right and don't need revision. It is not the laws. The Patent Office is all right too. There is no corruption there. It all lies with the power and practice of the United States Supreme Court. Years ago they would grant an injunction on the face of the patent. The patentee had better rights. Now they don't, and that is what is driving every good man out of the business, or driving him into details, because they are safe. If you get up a wrench there is not the danger of another man coming in and spending $200,000 or $300,000 fighting you on a thing which don't pay you $5,000." Again, Mr. Edison is reported as saying that instead of taking out patents, inventors should guard their discoveries as trade secrets and in the same breath expressing the following conclusion: "A man ought to patent every part of his machine which he intends to use, so that he will have a bona fide claim to use it, and cannot be infringed by other inventors. The inventor should first patent the principal parts and improvements, then patent the variations and completed model, to protect himself in the courts of law."

The fact of the matter seems to be that, while the patent system of the United States contains many defects and has often been abused, it still remains the best that has been devised, and it has contributed largely to the material advancement of the country and furnished protection and a means for securing reward for worthy inventors.

THE RECORD AND PROMISE OF THE ELECTRICAL INDUSTRY.

1897—1898.

It is very gratifying to record, in this New Year's edition of the Western Electrician, the undoubted fact that the electrical industry, in all its technical and commercial departments, has made a fine, healthy advance during the year. Comparing the condition of affairs to-day with that of a year ago, anyone who is familiar with the trend of electrical development must fairly acknowledge that the improvement has been a great and conspicuous one. Last New Years everybody was hoping, with some mental reservation of doubt, that there would be a betterment in the long depressed electrical trade; now it is known beyond question that the industry is in a far better position in every direction. The improvement was especially marked during the last three months of the year, and 1897 came to an end with confidence restored, a large comparative volume of goods sold, and much better collections. Better still, all agree that unless some unforeseen contingency arises, the year now entered upon will show a continued increase in the growth of the business—a healthy, natural recovery, not a speculative boom—and that an active demand for electrical products is indicated for several years. It may be well to suggest that in this renewal of industrial activity in this country the electrical manufacturers should not neglect the export trade, which has been so notably developed during the hard times at home.

Technical development is of course largely dependent upon industrial conditions. With improved prospects in the business world, the year has witnessed some interesting phases of the advancement of engineering thought. One is the conspicuous increase in the use of storage batteries for power stations; another is the marked activity in the development of large water powers by electrical transmission; a third is the change in the attitude of heavy-traffic railroad engineers toward electric traction; a fourth is the initial development of the multiple-unit system of electrical train operation; a fifth is the increasing employment of rotary transformers in combinations of alternating-current transmission and direct-current distribution for both railway and lighting service, and still another is the discussion of the 220-volt lamp question. In telephony the independent movement has advanced with vigorous strides, and the long-distance service has been greatly increased and extended. In the telegraph service, the report of the largest company shows a slight decrease in business compared with some former years. The year has witnessed one very important step in advance—the general adoption of the National Electrical Code—and two important patent decisions, one dismissing the government suit to annul the Berliner telephone patent and the other declaring the Vandepoele underrunning trolley patent invalid. The electric vehicle has been greatly improved and has shown that it has come to stay, while electrical cooking and heating has made progress.

Several of these subjects are briefly treated in the subjoined articles by contributors competent to speak with knowledge. No doubt many readers of the Western Electrician need no introduction to any one of the gentlemen who have kindly helped to make this issue of value; but it may not be amiss to say a word or two about each.

As general superintendent and electrical engineer of the Chicago Edison company, Mr. Ferguson is well qualified to write of central-station work, to which he has given years of study and in which he is a recognized authority. Mr. Arnold's work as a builder of electric railways and in general engineering practice is well known. He designed the power house of the Intramural railroad at the World's Fair and many other plants, and is the author of "Design and Construction of Electric Power Plants." Mr. Pierce is another of the leading electrical engineers of Chicago. At the World's Fair he had charge of the great electrical plant—undoubtedly the largest in existence at that time. He has a wide general experience and an extensive electrical acquaintance. Mr. Hibbard holds the responsible position of general manager of the Chicago Telephone company. He is vice-president of the American Institute of Electrical Engineers and his active mind touches on many problems of electrical endeavor. Mr. Clark is an experienced electrical man, formerly engaged in central-station management, but now the Chicago manager of the Electric Storage Battery company. Mr. Wallace is equally well known East and West, and as one of the western representatives of the Stanley Electric company in Chicago has given the subject of which he treats deep attention. Mr. Merrill has a national reputation as an expert on all questions growing out of the relations of the insurance and electrical interests. He is in charge of the Electrical Bureau of the National Board of Fire Underwriters, and his office is in Chicago. Judge James M. Thomas of Chillicothe, O., is the president of the Independent Telephone association and also of the Home Telephone company of Chillicothe. He is one of the most prominent figures in the independent telephone movement, which he indefatigably promotes. Mr. Corrigan is the manager of the American Electric Vehicle company of Chicago, and is one of the most active and intelligent of the exponents of the new industry in which he is engaged.

Central Station Advancement.

By Louis A. Ferguson.

During the year just closing much has been done in the development of the central station for the general distribution of electricity for lighting and power, both through radical changes in engineering methods and the gradual evolution and improvement of the apparatus and methods generally employed during the past few years. Looking backward only four years to the time of the World's Columbian Exposition at Chicago, we may remember how at that time it was generally considered that there was little prospect of any important change from established methods and apparatus then employed in central stations. Since that time, however, there have been marked changes and improvements in machinery, appliances and systems, through which the economy of electricity from central stations has been largely increased and their field of operation has been greatly widened.

The development of the electric elevator has done much to further the interests of central-station business, and the success of the electric elevator has been largely due to the lively interest taken in it by central-station managers and engineers and the appreciation of its value to them in the extension of their business in lines heretofore considered by many beyond the reach of the central station. The electric elevator is, in the hands of the central station manager, the key to the solution of the much discussed question, "Central-station supply versus the isolated plant."

It has been the firm belief of the writer for many years that the installation of isolated plants within the territory supplied by the central-station companies is, in the majority of instances, a mistake, when considered from a conservative business as well as engineering point of view. This has been most conclusively proven during the last few years, and especially during the year just closing. In Chicago, where many of the largest mercantile establishments, office buildings, hotels and railway companies have, after many years of operation, abandoned the use of isolated plants and contracted for their lighting and power serv e from the central-station company. The prominent architects of Chicago are so thoroughly imbued with the advantages to be derived from central-station supply that all the important buildings now being designed for low-pressure heating with natural gas as fuel, the ventilation is effected by electrically driven blowers and fans, and electricity supplied from the central-station mains operates the entire remainder of the equipment in the building. Direct-connected electric elevators are chosen both for passenger and freight service; the water for toilet rooms is furnished by electrically operated and controlled house pumps; the refrigerating and cooling also is provided for by ejectors operated and automatically controlled by electricity. The lighting, of course, as well as any power for special purposes in the building, is supplied by electricity from the central-station mains. In the case of office buildings or other buildings where there are several tenants, each tenant is supplied through independent meters and deals directly with the central-station company; thus the owner or agent of the building is relieved from the annoyance of engaging in a business in which he is not skilled and the office tenant is supplied with electric light at from one-third to one-half the amount charged these tenants in other buildings operating their own electric light plants.

Experience in Chicago has demonstrated that the day of the isolated plant in the central-station district of a large city is past, and the cases are very exceptional and must be surrounded by extraordinary conditions where an isolated plant may be operated at a cost, everything considered, less than the price at which it is possible for the central-station company to supply a better service and obtain a fair return on its capital invested.

In many cities and towns the competition of the Welsbach light has made an impression, and many of the companies have been at a loss to know how to compete successfully with this rejuvenator of the "good old gas." The Welsbach is, of course, a "hard times light," and no one would use it were it not that it affords a ready means of reducing expenses. To satisfy that class of people who are willing to use so cheerless and unnatural an illumination we must offer something that is economical as well as attractive. The year just closing has given us the successful small enclosed arc lamp, which, operating at three amperes, gives a better illumination without diminution of candle power for less money than the Welsbach burner.

It has always been argued that one of the great advantages of the series arc lighting business is that the load curve of the station has little or no peak, and the cost of operating and investment required should, therefore, be less than in low-tension stations, where the product is sold entirely by meter. There is no reason, however, why this principle may not be applied to low-tension stations as well, and the writer, two years ago, with this idea in view inaugurated, in connection with one of the low-tension stations under his charge, a system of commercial arc lighting on a weekly contract basis at a moderate price, adding to this one station alone upward of 700 low-tension contract arc lamps, some burning from dusk till 10 o'clock and others from dusk till midnight, and all being switched on and off by the company. This system has become exceedingly popular, and has resulted in so increasing the output that the load factor of the station is now 75 per cent. during its period of operation.

Municipal arc lighting from the low-tension three-wire mains is done in the East. In New York the Edison company furnishes the city lighting for Fifth avenue and many of the cross-town streets. In Brooklyn also the Edison company is doing a large business in municipal arc lighting from its three-wire system.

From an engineering point of view perhaps the most radical change and the greatest advancement in central-station practice and development has come from the proposed abandonment of all the steam generating stations in the various parts of the city and consolidating the steam plant and generating apparatus in one or two large central stations located on the water front, where multiple expansion condensing engines can be employed and where cheap fuel may be obtained. The electric energy for supplying the entire city and suburbs will then be generated at the main station on the water front and will be transmitted to various sub-stations located at proper points throughout city and suburbs. The energy generated will be either two or three-phase alternating or both direct current and alternating, according to the location of the generating station relative to the district of greatest demand. The transmission to the sub-stations, over one mile distant, will be by means of three-phase alternating current transmission lines at voltages dependent upon the distance. At the sub stations the voltage may be lowered by static transformers, the current rectified by rotary transformers and distributed to the city by an Edison three wire direct current network, if it be thickly settled. When the territory of the substation is scattering, however, a system of high-pressure alternating current feeders and step pressure secondaries would be employed. In many of the sub stations it may be found advantageous to operate series arc dynamos for municipal or commercial lighting, and in such cases the rotary transformers may be provided with pulleys and used to drive the arc machines at the same time they are converting the alternating to direct current. Synchronous motors taking current at the full line voltage may also be used to drive arc or other machines in case the sub-station be a purely arc station. The efficiency of the various systems combining the use of alternating and direct current ranges from 74 to 85 per cent., according to the method employed, and, compared in point of cost of operation with the old plan of many steam stations scattered about the city, the economy is very pronounced. Two-thirds of the cost of the fuel in the steam sub-stations and all the labor and supplies incident to the operation of its boilers and engines may be saved, and during 16 or 18 hours each day the rotary transformer or synchronous motor sub-stations may be operated with only one man and without any additional labor in the main station.

In our American stations the use of large storage batteries is increasing, and each year adds several

important installations to the list, some installing them because they believe them economical and useful to carry the peak in winter, others because they desire them as a guaranty for continuous service, thus protecting the consumer in much the same way that a bank protects its depositors by maintaining a cash surplus.

The question of rates and tariffs to central-station customers has been one of the most important questions under discussion during the year. There has been a constant tendency toward lower prices for current and a tendency toward revision of prices and methods of charging for current in the large cities, and experiments are now being conducted by several of the large companies along the lines laid down in the Wright demand system and the Kapp two-rate system.

The development of central-station systems along the lines herein outlined, employing alternating current for transmission and direct or alternating current for distribution, alters very materially the position occupied by many of the companies, enlarging their field of operation, developing their possibilities for greatly increased business, and by proper consolidation and good engineering may render prosperous companies which have for years been non-dividend earning properties.

The business of the central-station companies in all the large cities during the latter half of 1897 shows very large increases in output over the same period of 1896, demonstrating the strength of their position and indicating a very prosperous future for them and naturally a brighter outlook for the electrical business in general.

Isolated Plants.

By R. H. Pierce.

In the last few years we have seen in the electrical journals numerous articles on "Central Stations versus Isolated Plants." The discussion reminds the writer of the old question so popular with country debating societies, "Is the pen mightier than the sword?" Notwithstanding the floods of eloquence that have been poured forth in championing one side or the other of this momentous question, the manufacture of writing materials and more material weapons have both survived and both appear to be on the increase. So, notwithstanding the literary efforts of the man who says "Why buy light when you can own your own plant?" or his opponent who thinks he can see the finish of the central station, the sale of electricity from central stations and its production by isolated plants both seem to be popular and both are on the increase.

Only this imaginary antagonism makes excusable the repetition of the truism, which ought to be apparent to all, that there is a broad and profitable field for both methods.

Discussions have had little effect on progress of either. The question confronting the consumer is simply, "How can I get satisfactory electrical service most cheaply?" In solving this, he does not deal with the generalizations, but simply figures the relative cost of the two methods; at the same time, of course, considering the relative reliability and quality. Of course two men may figure out different results and come to opposite conclusions regarding the same case. This, it may be claimed, shows that after all the question is one for debate. To the writer it seems to indicate simply that each case should receive careful, impartial and intelligent study. With such study, in about 99 cases out of every 100 the advantage of one method or the other is clearly apparent. No doubt many an isolated plant has been installed where the owner would have saved himself much expense and trouble by buying current of a central station [illegible], a man has taken current from a central station and paid much more than it would have cost him to produce it.

Between the central station man, with figures demonstrating the enormous expense of operating a plant, and the machinery man, who figures out the absurdly small cost of doing the same thing, the consumer [illegible] pardoned if he is not always able to [illegible] weight to the many "facts" presented to him. We must not, however, judge the art by these errors, but rather by what the experience of good engineers and good business men has [illegible] the best practice.

As this journal will contain elsewhere an article on central stations by one of their most ardent and able champions, the writer will simply accept the isolated plant as a firmly established factor and allude briefly to a few of the reasons for progress made in the past year.

There are many conditions which favor the installation of isolated plants, but in most cases some one or two things decide whether or not it shall be installed.

In large store, office, hotel, theater and public buildings, as well as in many manufacturing buildings, the fact that the buildings are to be heated by exhaust steam decides the question of plant or [illegible] plant. As long as the [illegible] for steam for heating purposes is in excess of that required for running an engine, the cost of the additional fuel required to make [illegible] may be practically [illegible]. Since in a [illegible] plant the heaviest [illegible] is done in the month when the most [illegible] done, i. e., when the above condition [illegible], the average cost of fuel per kilowatt per year is often very low. Even recently it has been argued in one of the electrical papers that this saving is largely theoretical, but if we take the guess of a intelligent engineer who runs a plant and the speculation of the literary gentleman who discusses economy in technical language, we will find that the coal bills will show that the engineer's guess is the better guide for the man who pays the bills.

The real question is how we shall decide in a given case whether to install a plant. The answer is easy. The central-station man will figure for you the cost of buying current and will fully set forth the advantages of doing so. The other side of the problem is simply for the consumer to figure the cost of producing his own electricity and then compare the two estimates. If the consumer cannot figure this out to a certainty, he need not be discouraged, for there are plenty of electrical engineers who are only too willing to do it for him. Most cases can be settled by very rough figuring, but if the case is a doubtful one, then the proper course is to lay out a regular load curve for the plant. If the service is already being furnished by a station, this may be done from measurements. In the case of a new building, however, it is necessary to assume certain loads for the various hours of the day and construct an imaginary load curve, then select the machinery and apparatus of proper sizes to suit this curve and then figure out the cost of plant and cost of operation.

The "load factor" will determine whether the plant is a good investment or not; i. e., the ratio of the average load to the maximum load will determine both the cost and the economy of the plant. As both cost and economy may vary over a very wide range, it is not safe to take an average offered by either friend or foe on isolated plants. Each case should be figured out as a special case. Where this is carefully and honestly done, the actual investment and cost of operation both come much nearer to the estimated investment and cost of operation than can be obtained by studying the average results of other plants.

The reasons why operating an isolated plant must, in many cases, be more economical than buying current are:

First—Many of the isolated plants have as great a capacity as central stations which pay.

Second—Very often the load factor is better.

Third—There is often a great saving, due to the use of exhaust steam for heating, etc.

Fourth—In many buildings and manufacturing establishments, the operation of an electric plant calls for but little additional labor, and that not of a high grade, and if it does call for a better chief engineer, he usually saves more than the difference in his salary.

Fifth—The isolated plant usually costs less per kilowatt, owing to the fact that no capital is invested in costly distribution circuits.

Sixth—The depreciation of plant ought to be, and usually is, less.

The reason that we can expect an increase in isolated plants is that many consumers in the past, especially in the hard times, have been deterred by first cost, and as machinery has grown much cheaper we ought to expect more investments as prosperity returns. Again, in many cases the interest on the investment has proved a large fixed charge in estimating operating expenses of plant. With cheaper machinery and a decreasing rate of interest, we may expect many to revise their figures.

The most promising field for the past year, and one which so far from being exhausted is little more than opened, is the installation of isolated plants for operating factories by motors directly connected to individual machines, or operating groups of machinery. This is a most promising field. Much has been written regarding the efficiency of electrically driven machinery; perhaps this subject has been already more than sufficiently covered; but it does not take much calculation to see that when in many factories 60 to 85 per cent of the total power used is consumed in running idle shafting, ropes, belts, etc., there is a good field of operation in remodeling and rebuilding factory plants. If the question of efficiency were the whole thing, then we might find many cases where the efficiency could be greatly improved by redesigning the transmission system, without using electricity, and with, perhaps, a smaller expenditure than would be required to equip a plant with generators or motors. Investigation shows, however, that efficiency is not the whole thing, and often is not the main thing. The advantage of the use of motors means the saving of space, the better grouping of machinery, better control of speeds, convenience in handling materials and safety to operatives due to the absence of shafting, belting, pulleys, etc.

Electrical transmission in manufacturing plants is cheapest because it is best. In many factories the cost of fuel for power is not more than five per cent of the cost of labor. In such cases a method of applying power which will increase the efficiency of the labor five per cent. is better than any improvement in the old way, even if the efficiency of the electrical transmission is only one half that of the old method. It is safe to say that in most cases a properly designed electrical transmission plant will give an increased efficiency over old methods (i. e., effect a saving in fuel) and at the same time increase the producing capacity of the factory sufficiently to make the electrical plant the best paying investment that can be made. Such plants, from their location and from other other well recognized reasons, are usually isolated plants. Space and time do not allow our going into detail, but it would be interesting if the manufacturers would give a statement of the comparative number of motors and lamps sold for central-station and for isolated-plant use in the past year.

The writer does not advocate the installation of isolated plants except where their economy can be clearly demonstrated. He does not wish to pose as the champion of isolated plants versus central stations, but he does believe, and has always contended, that the isolated plant offers a field of work well worthy of the best efforts of any engineer, and his experience in the year that has passed leads him to believe that the field is constantly widening.

The Electric Railway of 1897 and 1898.

By B. J. Arnold.

During the year 1897 the most important development in the electric railway field has been the application of the third-rail system to steam railroad service, as exemplified in the installation of the Nantasket Beach line of the New York, New Haven and Hartford Railroad company. In this installation it has been proven that heavy railway trains can be handled successfully, reliably and with more satisfaction to the traveling public with electric power than with steam through the intervention of the independent locomotive. It has been but four years since the Intramural railway at the World's Fair was placed in successful operation, yet since that time electricity has been adopted as the motive power by all the elevated railways in Chicago, and it seems probable that we shall see, during the year of 1898, a number of the present suburban steam lines equipped electrically, following the lines laid down on the Nantasket Beach road. The Illinois Central Railroad company is at present figuring with a fair certainty of adopting electricity for its suburban service, for it is said that the company believes that it can give a better service to its patrons with electric power than with the present steam power.

The past year has also brought out the application of the storage battery on an extended scale for the propulsion of street cars, with the batteries carried upon the cars, thus making each car an independent unit, the exemplification of the ideal in railroad work. This system has been in operation for a little over six months on the Englewood and Chicago electric railway, with successful results so far as public service and economy in operation are concerned, although the relative cost of operation as compared with the trolley system has not been made public. The batteries, however, have shown excellent service, and the promoters of the enterprise have reason to feel satisfied with the results.

The year 1898 will probably see many applications of the storage battery as an auxiliary in the power stations of electric railways now in operation, for the advantages to be derived from the use of the batteries in this field are just now beginning to be realized by railway operators, as shown by the fact of their adoption for such work on a large scale at Philadelphia, Pittsburg and Cleveland, following their extensive application as auxiliaries to central lighting stations in Boston, New York, Brooklyn, Cleveland, San Francisco and St. Louis.

When it is recalled that but a few years ago to have been known as looking with favor upon the storage battery as having any value whatever was suicidal to one's reputation for sanity and engineering judgment, their extensive adoption and approval at the present time by the best engineers and most solid business establishments brings satisfaction to the few who were engaged in missionary work in this line. Especially must this be so with Mr. C. O. Mailloux, who advocated strongly in practice and with his pen the use of batteries as they are now being installed in many cases, but who had the misfortune to advocate their use nearly a decade ahead of time, on account of defects in the batteries themselves and the lack of proper commercial backing to substantiate the correctness of his ideas.

During the coming year the efficiency of the Sprague multiple-unit system, by means of which each car becomes a motor car, will be thoroughly tested upon the South Side elevated railway of Chicago. If the details of this system do not prove too complicated for reasonable maintenance, and it seems to the writer that they will not, it will prove the ideal system for elevated railway work.

For long-distance, cross-country lines the use of the three phase current generated direct from dynamos at 5,000 to 10,000 volts, and distributed by means of aerial lines at this potential to sub-stations, thence through rotary converters and battery auxiliaries to sections of trolley line from 10 to 20 miles long at a direct pressure of 600 to 1,000 volts, seems fairly reasonable to expect. In fact the details of such a system are worked out, ready for construction, by means of which 100 miles of railway is to be driven from one central station, and from careful estimates made upon the cost and operation of such a road, it is proven that it can be constructed and operated for less money than the present trolley system at 600 volts. With such a system the battery sub-stations act as equalizers by taking the increased load when the train is on any given section and maintaining practically a constant load upon the power station. The batteries, also, when large

enough to act as such regulators, have sufficient energy stored in them to continue the operation of the cars upon the system long enough to bridge over any ordinary breakdown in the power station, thus making the system more reliable than the present trolley system.

For city work the underground conduit system is proving itself successful in New York and Washington, and from this time forward it will be a battle between the storage battery mounted directly upon the cars and the underground system, and the year 1898 will probably demonstrate which is to be the victor.

Condition of the Horseless Carriage Industry.

By C. E. Corrigan.

It is to be remembered that before entering this field of enterprise one obtrusive fact demands and must receive due attention—the fact that there never was a great discovery or a valuable invention or any other really good thing that did not go a begging for recognition among experts and the general public and have to fight its way to acceptance.

But our difficulties have already been largely overcome. Those primitive motive powers, the patient ox, the mule and the horse, have been deposed in many fields of transportation and their successors have been and are being supplanted in turn by electricity, and people have begun to realize that electricity is the natural medium for the application of motive power. Its supply is unlimited. It is everywhere. It is to movement what the sun is to growth.

Meanwhile other methods and materials for producing power for horseless vehicles are seeking recognition. The gasoline and gas engines have and will have for some time to come a distinct field of usefulness, and they aid very materially in increasing and intensifying the demand for good streets and roads, the want of which constitutes one of the difficulties that is being overcome. The more populous the territory and the more enlightened the population, the better the roadways. All these wants are working together—in these days very rapidly—toward fruition. The good-roads question is a very live one at this time. For this the horse will also be thankful. Certainly we have to combat a greater or less sentiment in his favor; and we do it with poor grace, for he who does not appreciate a horse lacks something of being a man. Nevertheless, it is true that the horse is a much overloaded and abused animal. The meanness of mankind is illustrated in the too heavy load, the too long journey and the bad roadway, and the horse is beaten or encouraged into meeting these conditions and supplying all deficiencies. Some of his admirers might easily think that it is time he was relieved, somehow, from as much of this surplus of burden as constitutes cruelty. Good roads will help both him and his owner. Certainly there are places where we cannot altogether spare him. There could be nothing inspiring in the sight of a plump and splendid brigadier-general, waving a battle-scarred flag and cavorting around at the head of his troops on a bicycle; and yet there are a few young people of various ages who think the bicycle, too, has its place, and they, likewise, favor good roads.

One of the difficulties we have been overcoming is involved in the tire question, which it was the province of the bicycle to develop. True, the making of tires is an independent field, but the result is important to us. After long and thorough tests on passenger and freight vehicles, we find that for the luxurious family carriage or the buggy, and with smooth, clean pavements, the pneumatic tire is the proper thing, but for parcel-delivery wagons, under more or less strain of burden or roadway, the cushion or the solid tire is much better, and both meet their own conditions effectively. It took a little time to learn this, because the public always demands extreme conditions the utmost immediately. But this again encourages effort and helps progress. For instance, customers asked us for a vehicle that would run all day with one charging of the batteries—and this must not increase their weight. To meet these conditions we succeeded in getting batteries that will run a wagon on fair roadway from 40 to 60 miles a day with one charging, while at the same time of about one-third the weight and bulk of anything else we have been able to learn of. With frequent stops and over various sorts of roadway the wagons now in use for several months by a prominent silk merchant of Chicago have averaged per wagon 37 miles per day, as registered by the rodometer. This method of ascertaining distances is one the owners of horse delivery wagons should adopt before too positively stating the totals. The owner says that the electric wagons travel much faster, stop quicker, start easier and do much more work in a day than any horse wagons he has had experience with.

All the same, this is an extreme test. The last part of a discharge is more wearing on the batteries and it is always more satisfactory to have plenty of power in reserve. A given amount of force is more effective if backed up by a surplus of volume. The daily working and the overworking of a man's muscles or his brain illustrate this truth; therefore we have found it economy to use duplicate sets of batteries or to recharge the one set, say at noon when the horse would be eating. Nature is always making valuable suggestions, which help us to overcome difficulties.

Direct current of 110 volts can usually be obtained, but for livery stables or large mercantile houses a gas engine and generator will be found more economical. A difficulty now being rapidly overcome is the want of a sufficient number of large power supply plants, which will reduce the expense of current to the minimum. No doubt the needed plants will prove very profitable investments, so very general and various are the uses to which electricity is being applied. A gentleman who probably has as much capital invested in such power plants as any man in this country told me that electric power could be profitably produced and delivered at a cost of one cent a kilowatt-hour—a statement which I confess astonished me and the correctness of which I could not have accepted as probable had it come from a less reliable and disinterested authority. This being a utilitarian age, in which the greatest economy in producing the greatest result is the all-important question, such a fact as the above seems to contain in itself the rapid solution of our remaining difficulties.

The Telephone in 1897.

By A. S. Hibbard.

The year 1897 has been of especial interest in the field of telephone engineering. Plans for the operation and maintenance of large telephone exchanges which were proposed, and to some extent put in operation during the two or three years previous were, in 1897, combined and concentrated in the one general scheme which has been widely adopted, and in a number of important exchanges put into successful practice. The principal feature involved is the operation of the entire plant for signaling and transmisison of speech from one central battery located at the telephone exchange. This dispenses with the small primary batteries at subscribers' stations, as well as with the magneto crank-handle generators which have been used for so many years. The telephone user signals the operator by the movement of the switch on which the receiving telephone is hung. Removing the instrument from the switch or hook lights a small incandescent lamp before the operator. The insertion of the answering plug puts out the calling lamp, and during the conversation, a similar lamp guards the pair of cords used in completing the connection. If the cord lamp is flashed, the operator responds. If it lights steadily, she disconnects the circuits. The operator is thus directed in all her movements by a visible signal controlled by the telephone user. A most decided and substantial improvement in service has thus been accomplished. The apparatus which has been devised and manufactured to accomplish these results, consisting of relays of various forms for the different uses, repeating coils, low-voltage lamps, sockets, spring-jacks and keyboard apparatus, is most ingenious and perfect in its operation, and in its detail represents a great advance and improvement over anything previously manufactured.

By means of the perfected signaling devices the work of handling trunk calls from one exchange office to another has been greatly expedited, and this service is now made so rapidly and so surely that it is not possible for the user to distinguish between a trunked call and one completed by one operator.

The establishment of a sufficient number of branch offices to accomplish the best economy in the wire plant is thus made possible, a result which also increases the efficiency of maintenance. In large exchanges the wires have been concentrated still more in cables laid in subway ducts, being brought out in short distributing lines, and the large majority operated are now metallic circuits.

Central office power and battery plants have been greatly extended and enlarged, storage batteries being used charged by motor-dynamos with gas engines for reserve power.

Party lines for residence service have been extensively introduced during the year on plans for selective signaling which (with the wire plants as now maintained) have been found efficient and satisfactory.

New York city continues to head the list of exchanges in the country, having nearly 20,000 telephones in operation, while in Chicago, with about 15,000 telephones, the number of daily calls continues to be greater than in any exchange in the world. In Chicago also a greater area is covered by the exchange, and it is found that an average of 3½ miles of wire is used in each connection. As the daily number of calls is about 220,000, it will be seen that 770,000 miles of wire is connected up daily in Chicago for telephone calls, or enough to reach 30 times around the earth.

Long distance and other toll line systems have been greatly extended during the year. Minneapolis, Omaha, Kansas City and St. Louis now represent the western limits, Nashville and points in Alabama, the south; while all Atlantic seaboard cities are connected by direct lines. On the Pacific coast long distance lines extend from Washington and points in Oregon to San Diego, and the growth in the number of telephones has been unprecedented. In San Francisco various classes of service are offered on the toll or measured-service plan, each message being paid for at the time service is given, and the year closes with 11,000 telephones in use in that city.

Throughout the entire country the value to the various communities of reliable and efficient telephone service has continued to increase. More telephones have been installed than ever before and their daily usefulness has increased. In providing for this vast service of inter-communication, now amounting probably to 100,000,000 conversations yearly, no previous year has shown such substantial advances and improvements as 1897.

The Independent Telephone Movement in 1897, Its Development and Organization, and Its Prospects for 1898.

By James M. Thomas.

The independent movement for 1897, the year just closing, already forms a most important chapter in the commercial history of this country.

The popularity of the movement can no longer be doubted. No enterprise has ever been more welcomed by the people, who have had its advantages fully demonstrated. The year 1897 has proven that a better telephone service can be furnished at half the cost paid before this movement started, and the investors rewarded by a handsome profit.

People who have watched this movement know that the telephone is fast becoming a necessity, not only in the large cities but the small ones, even the villages; not only in the business house but in the residence; not only in the municipalities but in the rural districts. They also know that having become a necessity the exorbitant prices heretofore charged will not be tolerated. They also know beyond a doubt that the independent telephone has come to stay, and that its usefulness will become greater as the number of users increases.

The development of this enterprise in 1897 has been wonderful. Exchanges and toll lines have been built all over the United States, and many franchises have been granted for exchanges not yet built. Many small cities heretofore without the advantages of the telephone have been furnished with service, not only among their own citizens, but have been given connection with other cities.

The larger cities have become interested and many have built exchanges. Franchises are being granted in others, and it can be truly said that the year 1897 marks the beginning of the movement in the larger cities. Detroit, Fort Wayne, Mobile, Sacramento, Cleveland, Baltimore, Newark, Richmond, Norfolk, Grand Rapids and other large cities have demonstrated that the movement can be successfully carried on in larger municipalities. St. Louis will open the largest independent exchange in the United States within the next six months.

The enterprise has been taken up in Chicago and New York. The underground work for the new exchanges in Saginaw and Bay City, Mich., is about completed, and hundreds of exchanges scattered throughout the union are now in process of construction, while toll-lines and long-distance connections are being built in all directions. The close of the year 1897 shows a great advancement in this movement.

More than $25,000,000 is already invested in independent telephony. There are about 1,100 exchanges in operation and in process of construction. There are about 600 franchises granted in cities where exchanges have not yet been built. There is over 20,000 miles of toll-lines now completed, owned by the independent companies and many thousand miles in process of construction.

The output from independent factories has increased to a surprising extent in 1897, and many new factories have entered the field this year. Others are ready to start with the new year.

The improvement made in the telephone apparatus during the year 1897 is not only encouraging but shows the ability of the men to compete in an open field where there is a reward for inventive genius.

Inferior telephones and switchboards have been replaced with improved apparatus, until now the greater part of the independent exchanges have equipment equal, and in some instances superior, to exchanges owned by the opposition.

The independent telephone movement has not only advanced itself, but the opposition has been spurred to new energy. Slow service is no longer tolerated in cities where exchanges both of the independents and opposition exist. The operators must be quick, obliging, courteous and pleasing. An all night service is now required in smaller cities where, before the independent exchange came into being, a day service was only given.

The number of telephone users has increased about five fold in cities where there are two exchanges. The independents have, at 50 per cent. of the rate of the opposition, succeeded in placing from two to four times as many telephones as were operated by the opposition before they entered the field, and the opposition has succeeded, by giving free service, in increasing their numbers.

Thus the education of the people in the use of the telephone has been very rapid, and the cheapness of its service has brought it within the reach of the masses of people.

It is a remarkable fact, even at this, the close of the year 1897, about three years since the beginning

of the independent telephone movement, that in cities where there is no competition the people are furnished very poor telephone service. This is only because they have no knowledge of the great benefit to be given them by competition, not only in service but in reduction of cost.

This movement reached a point early in 1897 of such great proportions that those interested in its welfare recognized the necessity of organization. The history of all other enterprises showed clearly that this was essential to the welfare and progress of this movement, so an association of operators was formed at Detroit on the 22d day of June, 1897, at a convention called for that purpose. "The Independent Telephone Association of the United States of America" was adopted as its name. Its work has been quietly but effectively done, and this organization has been heartily endorsed by all who have the good of the movement at heart. Small opposition has developed in some quarters among the independents who have had mistaken notions of its objects, but a careful study of the constitution and a little insight into its management have always satisfied the independent investors of the good work already accomplished and the great work of the future.

Of course the idea of organization among the independents has not been encouraged by the opposition, and much has been said and done to retard its growth, but it has continued to grow and will grow when it becomes known by all that the work of this organization has given a new impetus to independent telephony and has encouraged capital to invest in this movement.

The policy of this organization has not been to announce its movements from the housetops, and to publish long columns of figures in the newspapers and journals, but to work quietly for the promotion of all the independent telephone interests and to keep itself free from selfish influences. This policy is bound to win; it has always won in every public enterprise.

We come now to the prospects of 1898. This is a part of the subject that would admit of the flight of imagination and even of poetry, but as someone may read this prophecy late in the year 1898, it is best to indulge only in thoughts guaranteed by what we are able to see in the present, which has been in turn the result of the past.

The independent telephone movement will no doubt find even greater opposition in the year 1898 than it has had in the year 1897, but on account of its increased strength will be able to overcome opposition more easily and will develop much faster. The work will be taken up with more vigor in the larger cities, and long-distance telephony will be attractive to capital.

The term, "A few mushroom companies out in the West," will not be applied to this movement at the close of the year 1898, and the old phrase "natural monopoly" will no longer have a meaning in the telephone vocabulary. St. Louis will then have demonsrated that a 10,000-drop switchboard can be operated to its full capacity by an independent company, and Chicago and New York will have granted franchises for independent exchanges.

The year 1898 will bring to the independent movement more capital than the three preceding years have brought.

Rapid communication, not only by telephone but by telegraph, will be stimulated, and all companies will feel more and more the growing demand for more rapid service. We are just at the dawn of the day when quick communication at reasonable prices is demanded, and the year 1898 will show the people the great value of such service.

Great quantities of material will be in demand on account of the independent telephone movement in 1898. Its movement will be felt in every artery of trade, and every class of men, from the woodsmen who cut the poles in the forest to the skilled workmen employed in the factory, will reap the benefits of the demand on account of this movement.

Better equipment will replace the inferior, and the best construction possible to build will be the order of the independent movement in 1898. This will also be true of the opposition.

One advantage the independents have, and that is that they will not have to tear down property to build new, but [illegible] be able to start with proper construction and equipment.

Will the year 1898 [illegible] the end of patent litigation in the art of telephony? Man knoweth not; so far as this movement [illegible] concerned it matters little. Men of wealth and influence all over the country have concluded that the time has come when the microphone [illegible] dedicated to the use of the public under our law[illegible], and their movements can only be stopped by decrees of courts. The great masses of the people think [illegible] right.

In view of the great demand for telephone service, it is bad policy for the opposition to try to kill this independent telephone movement by trying to enforce imag[illegible] rights [illegible] in the mind of a few technical men by [illegible] the defective patent law governing [illegible] of patents.

The Denison and Choctaw Telephone company [illegible] extended its line from [illegible] to San Bois in the Choctaw nation. Other [illegible] are contemplated, and in a short time the company expects [illegible] the system in operation all over the Choctaw nation.

Long-distance Power Transmission.

By J. B. Wallace.

Probably no branch of electrical industry has made greater progress in the last few years than power transmission, for the reason that cheap and convenient power is one of the requirements of most successful industrial enterprises. By utilizing electrical power transmission large power units have been substituted for numerous small ones, large amounts of manual labor and fuel have been saved, and transmission losses have been largely reduced, thereby cheapening the cost of power.

The convenience and availability of electrical power as compared with other forms of energy have been practically demonstrated in various lines. In some cases it is particularly noticeable, as, for instance, in certain phases of the transportation problem. The whole field of electrical power transmission has been broadening, and its commercial advantages are being better understood and appreciated with each practical demonstration.

The latest development in this field to attract general attention, and probably one of the most ultimate importance, is that of long-distance power transmission, and under this head all electrical power transmission may properly be classed where the electricity is generated at a distance from and transmitted to a center of distribution at a higher voltage than that used in its distribution, this being essential from a commercial point of view if the distance is actually long and the distribution general.

The development of alternating current apparatus and step-up and step-down transformers, admitting of the use of high voltages in the transmission line, has made the transmission of large volumes of energy a considerable distance with a comparatively small loss and cost a possibility; the development of multiphase apparatus has further reduced the cost and greatly increased the flexibility of the distribution, while the appearance of the inductor type of alternating current generator has still further simplified the problem by making it practical to build the generator itself for the high voltages desired for transmission, thus doing away with the step-up transformers and securing a closer regulation and higher efficiency than is obtained from the old-style of machine.

The utilization of a small part of the immense power of Niagara Falls aroused a great interest in the subject of utilizing water powers and transmitting their energy by means of electricity considerable distances to an established demand for the power. Prior to the introduction of electrical power transmission it was necessary, in order for industries desiring to utilize the water power developed, to locate directly upon it, but multiphase apparatus and high voltages have changed all this, and to-day wherever water power can be developed within, say, 50 miles of an established demand for it at a reasonable cost, it is practicable and commercial to transmit the energy to the demand by means of electricity, and once the necessary investment is made for so doing the cost of operating and maintaining a hydraulic and electrical equipment is only a small percentage of that required to operate and maintain a steam power plant.

The cost of the hydraulic development and the value of power at the point of distribution practically settle the question of whether the investment will pay, irrespective of the distance. The actual distance has very little practical effect upon the cost of the electrical equipment, aside from the cost of the line, and consequently the cost of the line and value of power at the end of the line decide what is the most economical loss to figure upon, and whether it is advisable to increase the investment in copper to reduce the loss, or vice versa. The handling of the high voltages necessary for economical power transmission over long distances and the insulation of line and transformers is no longer looked upon as an engineering difficulty to be overcome, but a practical and commercial success. By the use of porcelain insulators the bare copper transmission lines are better insulated than the average distributing lines where the so-called weather-proof insulation and glass insulators are used, and it has been demonstrated over and over again that high potential transmission lines can be carried through comparatively populous districts with no greater danger to life or property than is incurred by the distributing lines in towns and cities at a lower voltage. In a large number of the states from Maine to California, where natural water powers are located, important developments have already been made, and their energy is being transmitted by means of electricity. These plants run in size all the way from 100 horse power to an ultimate capacity of over 20,000 horse power in some cases, and many of them have already demonstrated by their operation that long-distance power transmission is not only practical but exceedingly profitable, offering in many cases very large returns upon the investment required.

The conditions of hydraulic development for power transmission and distribution vary very largely. As a general rule in the eastern states water power is developed by means of large quantity and comparatively small head, while in the mountain states the reverse is true; the volume of water, [illegible] a rule, is comparatively small, while very high heads are obtained. In the former case turbine wheels are usually used; in the latter wheels of the Pelton type; and various methods are used for their application and regulation. In fact, this branch of the business has opened up a large field for electrical and hydraulic engineering.

The use of long-distance power transmission, however, is by no means confined to the transmission of water power to a distance; but, on the contrary, as it is cheaper in many cases to transmit power by electricity than to transport fuel, particularly where fuel has to be rehandled or hauled by teams, this is also opening up a very large and important field, and it is a point that should be considered in the location of every new power station.

It must be borne in mind that it takes no more copper to carry 1,000 horse power at 10,000 volts 10 miles with a given loss than it does to carry 1,000 horse power at 1,000 volts about one-tenth of a mile with the same loss. A practical illustration of the difference between using high and low voltages is that of a consumer of light and power who is now supplied over a transmission circuit of 18 miles at 10,000 volts and a distributing circuit of one-half mile at 2,000 volts with less loss in the transmission than when he was previously supplied by a 220-volt circuit only a few blocks distant, so that while over 18 miles farther from his source of supply he is electrically nearer to it. Therefore if a central-station plant for a city can be built outside of a city, where land is cheaper, so that the cost of the installation and the transmission to the point of distribution, with a loss at full load of five per cent., could be put in for the same money as a plant at the center of distribution, and a saving in the cost of fuel at the outside location would mean the saving in the cost of generating the current of 10 per cent., a continual saving in the operation of the plant could be made of more than five per cent. On the Atlantic coast there are numerous large manufacturing companies using large amounts of power that could undoubtedly effect a considerable saving by placing their power stations at tidewater and transmitting their energy from thence to their factories, rather than to rehandle and transport their coal. In some mountain districts where the demand for power is at an elevation of several thousand feet higher than adjacent deposits of coal, it would undoubtedly be cheaper to generate the power at the coal mines and transmit it to the demand by means of electricity than it would be to haul the coal to the same point.

Long-distance electric railroad work is also opening up a large field for long-distance power transmission, as quite a saving can be made by consolidating the power stations into large units, generating the current at high potential by multiphase alternating current apparatus, and transmitting it to rotary transformer stations feeding into the line.

The distribution of electrical power transmitted long distances at high voltages can be made through and by means of any of the existing distributing circuits, synchronous and induction alternating current motors, rotary transformers, synchronous motors driving constant or varying potential direct current machines, and alternating current arc lamps, enabling the most general distribution to be made and in connection with all existing installations.

To sum up, the advantages of transmitting water power by means of electricity and the transmitting of power in the place of transporting of fuel are so great in so many cases that it seems quite probable that in the course of the next 10 years as large an amount of electrical energy will be generated at a distance and transmitted electrically to a center of distribution as will be generated directly at the center of distribution, and probably most of the valuable water powers of the country will be utilized.

Electrical Construction and Inspection.

By W. H. Merrill, Jr.

In any review of the progress made in electrical engineering during the past year the importance of the universal adoption of the National Electrical Code as standard specifications, covering the safety of electrical wiring, should not be overlooked. That bodies of such recognized importance as the American Institute of Architects, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Street Railway association, the Factory Mutual Fire Insurance companies, the National Association of Fire Engineers, the National Board of Fire Underwriters, the National Electric Light association and the Underwriters' National Electric association, besides all of the underwriters' organizations covering different sections of the country and nearly all of the municipal electrical departments of the United States, have agreed that this code is superior to anything heretofore drawn and suitable for adoption and enforcement as a uniform set of rules, is certainly worthy of note, and argues well for the future content of the engineer or construction company doing work in different sections of the country.

Uniformity of rulings by all inspection departments in all sections means much to all the interests involved, and as the year marks the greatest forward step yet made in this direction it is especially noteworthy.

The fire losses from electrical causes and the accidents and deaths resulting from electricity have exceeded last year's record to some extent, as would naturally be expected with the extension of electrical work constantly carried on. Electricity was and has been responsible for but a small pro-

portional part of the total fire waste, however. A rough estimate credits it with about one forty-fifth of the total annual fire loss, which amounts to approximately $140,000,000.

Throughout the year the marked advance in the stability of electrical construction work, as shown by the plants which have been installed or improved with an apparent view to permanency, is a most encouraging sign, showing, as it does, that investors no longer look upon electrical systems for distributing light and power as other than permanent structures.

Storage Battery Applications.

By Frank H. Clark.

The future of the storage-battery business would seem to be as promising as that of any of the electrical industries. This class of apparatus has long since passed the experimental stage, and though not so universally used as an auxiliary to central-station and isolated lighting plants in this country as in Europe, individual installations have been made here on a much larger scale than any on the other side. Within the next three months there will be installed in this city a battery as auxiliary to central-station lighting having greater capacity than any previous installation. At the same time an installation will be made in a neighboring city for railway station regulation which will have double the capacity of any hitherto made for a similar purpose. These installations will necessarily give an impetus to the storage-battery business.

New fields for the introduction of storage batteries on a large scale are constantly developing. An important instance of this is the rapid development of large water power plants for supplying electric energy to railway, lighting and power companies and to manufacturers of calcium carbide, carborundum and other articles requiring electricity in large quantities. At present these water power companies do not limit, strictly, the maximum amount of energy to be taken by the customer so long as the average taking does not exceed the amount contracted for. As the demand approaches the supply, however, regulations will doubtless be adopted, limiting the maximum to be taken to the contract amount. This will compel the user to provide a means for storing surplus energy when using less than the contract limit for use when the demand exceeds that limit. Nearly all street railways have a peak load of about an hour's duration, morning and evening, while all central lighting stations furnishing current by meter have an evening peak of generally less than two hours' duration. Should a railway or lighting and power company desire to contract with a water power company for electric current to meet the demands of its business, it would seem quite evident, therefore, that it could not afford to pay for the same on the basis of maximum requirement, and equally evident that the water power company could not afford to furnish the excess of current required for the peak load previously mentioned except at a rate which would be prohibitive. By the aid of a storage battery this business might be made mutually advantageous.

A similar opening for the storage battery is presented in the extension of central-station business by the installation of batteries on the premises of large users of current, to be charged from such stations at period of light load at a low price, current to be taken from the battery by the customer as needed. In this way the central station can secure a sale of its product at a time when the cost of production is almost negligible. No additional labor or station and distribution equipment being required, practically the only item of cost would be the coal. On the other hand, the consumer would be enabled to use the current at a time when if taken from the mains of the producing company the maximum charge would be made. One large eastern central-station company has already successively exploited this class of business.

The electric vehicle, which can be operated successfully only by the use of storage batteries, will probably create a larger future demand for batteries of moderate size than any other industry. While development in this, as in some other lines of storage-battery work, has not, perhaps, progressed as rapidly in this country as in Europe, electric cabs have been sucessfully operated in New York for many months and are found on the public stands for hire. In Chicago a few electric vehicles are also in use. A recently organized company with ample capital has in course of manufacture 100 electric cabs for public service in New York city. As it is but a step from the electric cab to the electric omnibus, may we not expect to see, and that soon, a change in urban transportation far more radical than that from horse car to "trolley"? The development of the ball bearing, the pneumatic tire and the asphalt pavement make this more than possible.

Without doubt more time, money and engineering ability have been expended upon the problem of battery traction than upon any other in the scope of the storage battery, and yet until recently but little success has been attained. Many if not most of the failures in this line have been largely due to the fact that reduction in weight, which means reduction in life, has been considered the first requisite. Experience has shown, however, that this feature is only secondary and of minor importance, while reliability and endurance are the chief requisites. Improved process of battery manufacture and handling have brought storage-battery traction within the circle of commercial success. To-day, in our own city of Chicago, a street-car line is successfully operated by storage batteries with a speed schedule in excess of a majority of "trolley" roads. This road has been in operation a year, and though it will require a longer time to determine just what the cost of battery maintenance will be, sufficient experience has been had to demonstrate that such maintenance will be less than one cent per car-mile. Compare this with the interest and depreciation on the increased cost of an underground trolley system, and it will be found that there is more than a possibility of profit in storage-battery traction.

As a regulator or governor of fluctuating electric loads, whether power or lighting, the storage battery is ideal. By no other device can the extraordinary and constantly occurring fluctuations which prevail in railway power stations be so quickly and accurately governed. By eliminating these fluctuations, the capacity of the station is greatly increased. At the same time the maximum efficiency of the generating plant is secured, with consequent increased economy. The same thing obtains where power is distributed to several units having variable loads, and particularly where it is desired to operate power and lighting circuits from one generator or a single bus-bar. It is claimed that a recent test made in New York developed the fact that, with a battery in parallel, starting a motor load of 1,200 amperes at 220 volts on the same bus-bar supplying current to 200 sixteen candle power lamps produced a variation in potential at the lamp of less than one per cent. It would thus appear reasonable to expect that as the advantages of the storage battery as a regulator become better understood, its use will become almost universal.

Recent developments in train lighting with the storage battery as an important adjunct warrant the belief that the electric light will at no distant day be universally used for illuminating day and sleeping coaches on all steam railroads. In the West to-day a "limited" train train which is not electrically illuminated is considered passé. One of the largest steam railway companies in the country is equipping 50 of its day coaches with dynamos and storage batteries of a system which has been successfully tested on the Pensylvania railroad for months.

It being impossible to charge storage batteries with an alternating current, it was thought that the rapid extension of the alternating systems might limit the scope of the battery. This probably would have been the case but for the development of the rotary converter. By the use of this ingenious machine current can be stored from an alternating system to be distributed at will as direct current, or it can be used to furnish direct current to the "rotary," to be turned into alternating current at any required potential or phase. This is actually being done to-day by two large companies using direct and alternating systems. A power plant using alternating-current generators and motors could, by the aid of a "rotary" and battery, store surplus energy and turn it back into alternating current for operating the motor load or lights at time of peak.

In addition to the above, the growing demand for storage batteries for isolated lighting plants, electric launches, telephones and telegraphs, fire-alarm and police-signal work, and in the smaller lines, such as automatic musical instruments, phonographs and dental and surgical work, will create a business which, though initially small, in the aggregate will assume very large proportions.

The Telegraph in 1897.

There is no repository of the yearly statistics of all the telegraphs of the United States, but a very good comparative idea may be obtained from the annual reports of the president of the Western Union Telegraph company to the stockholders. Probably three-quarters of the commercial telegraphy of the United States is transacted by, or over the wires of, this company, so that its reports may be fairly taken to represent the general condition of telegraphic communication in the country. President Eckert's latest report was made on October 13, 1897, and it shows that at that time the company had 190,614 miles of poles and cables, 841,002 miles of wire and 21,769 offices. During the year then reported it transmitted 58,151,684 messages, receiving therefor $22,638,859.16, at a profit of $5,73?,203.13. The average toll for each message was 30½ cents, and the profit on each message was a trifle over six cents. During the year 606 miles of pole lines, 14,073 miles of wire and 44 offices were added to the system. The number of messages transmitted shows a decrease of 608,760 from the number transmitted last year. "This decrease," says General Eckert, "was in a great measure due to the continued depression of general business throughout the country during the fiscal year to which the figures refer, although part of it is to be attributed to the business transmitted over leased wires, the returns from which are not accounted for on a message basis."

The total revenues for the year show an increase of $26,122.88 as compared with the previous year. The expenses for the year show an increase of $101,899.03 as compared with the previous year. The outlay for operating and maintaining the lines and offices, and for the equipment of new wires and offices, was practically the same as for the year before. The increase in the total expenses was due to the settlement of long-standing disputed tax accounts with several states, which were finally adjudged by the Supreme Court of the United States. The cost of construction of new property for the year was $449,747.07.

In conclusion the president says: "The condition of the company's property is being continually improved by the use of the best material and most modern appliances in all construction and reconstruction. The company has shared in the revival of business since the close of the fiscal year. Our test office weekly statements continue to show a substantial increase in our receipts. If the same percentage of increase is kept up throughout the current year, as the present commercial conditions indicate that it is reasonable to expect that it will be, the next annual statement will show a larger balance after the payment of interest and dividend charges."

Compared with preceding years, it may be noted that the exent of pole lines, miles of wire and number of offices are now at the highest mark in the history of the company. The number of messages transmitted in 1897 was, however, the smallest since 1890, the banner year being 1893, with 66,591,858. In revenue the years '91, '92 and '93 show up better, the last of the three being the greatest. In expenses 1893 alone shows a greater total than 1897. As to profits reported, the sum is the smallest recorded since 1889 and was also exceeded in the years 1880 to 1884, inclusive. Generally speaking, the average tolls per message show a steady and gradual decrease from the $1.047 of 1867 to the 30½ cents of 30 years later. A decline is also shown in the average cost to the company for each message, although the present figure, 24.3 cents, was exceeded very slightly as far back as 1878, when the average tolls were 38.9 cents and the average cost 25 cents, showing the neat profit of over 55 per cent.

BUSINESS OUTLOOK.

In reply to a number of inquiries addressed to representative electrical manufacturers and dealers by the Western Electrician, asking for a business review of the year just closed, with the prospects for the new year, the appended statements were received. In general, the prospect, as will be seen, is a very satisfactory one.

Lakon Company, Elkhart, Ind.: Business is good and the prospects are very bright for the coming year.

Diamond Electric Company, Chicago: Our trade is better this fall than ever before, and the prospects for the coming season are good.

W. F. Warner, Muncie, Ind.: I regard last year as having been an exceedingly prosperous one for the telephone public. However, I am expecting 1898 to be the banner year.

Hobart Electric Manufacturing Company, Troy, Ohio: We have had all we could do during the year, have plenty of orders at present, and do not know anything about what the future will bring forth.

Ohio Electric Works, Cleveland: We are not qualified to speak of "prospects." All our business comes from advertising and hard work. We have a tonic that makes "prospects," but it's only ink deep.

Vindex Electric Company, Chicago: We shall be well satisfied if our business for 1898 shall equal that of the year just closing. Judging from the increased inquiries and orders received during the last six months we predict a continued improvement in business for the coming year.

New York and Ohio Company, Warren, Ohio: We have had a prosperous year and believe the prospects for the year 1898 are very bright. Some of the purchasing agents are commencing to realize that there is a difference in quality, and that the lamp selling at the lowest price is not always the cheapest for them to buy.

Inter-Mountain Electric Company, Salt Lake City, Utah: The business of the past year has been a great improvement over that of the several preceding years, and the outlook is favorable for a continuance of this encouraging condition during the year to come, although there is nothing at present of any magnitude in our line.

Warren Electric and Specialty Company, Warren, Ohio: The outlook for the coming season to us seems very bright, judging by the past season. This success we attribute to our having made a good lamp and to the fact that we let the public know of it, and that we have so thoroughly exposed the disreputable methods of the trust.

Burnley Battery and Manufacturing Company, Painesville, O.: Business has been very gratifying, not only in the battery line, but with the Burnley soldering paste. Taking as an index the increasing business of the last two months, we have reason to believe that the advent of the new year will bring to us increased prosperity.

Standard Underground Cable Company, Pittsburg: We take pleasure in saying that the past year has been a prosperous one with us. Prices have been very low, but with a large volume of business and careful economy in manufacture the results have been most gratifying. We believe that better prices and [illegible] business will be the rule next year.

Fort Wayne Electric Corporation, Ft. Wayne, Ind.: There never was a brighter [illegible] before the electrical industries generally than [illegible] year. Money seems to be plenty and at very low [illegible]ures, practically speaking. As to the business outlook, we cannot say what others are doing, but [illegible] from our own work. We are operating to-day [illegible] two hours out of the twenty-four, with a full double shift of the force. Our arc business has been, [illegible] fore, exceedingly good. Our alternating work [illegible] exceeds our fondest hopes. As to the direct-current work, we are unable to take care of the orders then come to us. While we have doubled our meter and [illegible] departments three times the past year, we should to-day

double them again. The great amount of work in prospect has compelled us to contract for a factory in addition to our present factory, 266 by 68 feet, with a gallery, and a laboratory in addition to our present laboratory, 150 by 38 feet. We trust the incoming year finds the future as bright for all other electrical concerns as it is for the Fort Wayne Electric corporation.

Globe Carbon Company, Ravenna, Ohio: Our business has shown a steady increase since June 1st, last, and from the present indications we feel assured that prosperity in our particular line, at least, has returned and will remain with us. Because of the steady increase in our business we have had to add new machinery and additional help, and we are still considerably behind in orders.

Storey Motor and Tool Company, Philadelphia. We consider the business outlook for the coming year as being vastly better than it has been at any time during the past three or four years, and we think the return of confidence is being generally felt in almost all industries at the present time. Also that the prospects are it will be even more decided during the coming year.

Bullock Electric Company, New York: Our prospects were never brighter. During the year our own business has more than doubled that of the previous year, and we now have so many orders on hand for delivery next year that we have decided to build a new factory in order that we may handle the increase of trade. Judging from our experience, we believe that the entire electrical industry will make more rapid strides than ever before.

Albert & J. M. Anderson Manufacturing Company, Boston: We are never inclined to be sanguine; but we think that there will be good business for the manufacturers who have goods to place on the market which have proved to be reliable. We have made a larger number of heavy switches and switchboards the past year than ever before, and expect to gain in this line for the coming year, having improved facilities and a wider experience.

Kokomo Telephone and Electric Manufacturing Company, Kokomo, Ind.: We have had a very prosperous year and have also received orders ahead that will carry us well into the new year. For the last three months we have been running continually behind our orders, and, finding the present quarters too small for fast increasing business, we are now building a new factory that will increase our capacity to meet the requirements of the trade.

Fuller & Curtis, Detroit: So far as we are concerned business is very good, we thank you. We have more work than we have had for some time, and it keeps increasing. We are making good fans and motors, selling them cheap and delivering them promptly, and why should not business be good? We have orders on our books which will keep us busy till next June, but we have plenty of room for more and will be glad to hear from everybody that wants anything in our line.

Emerson Electric Manufacturing Company, St. Louis: Inasmuch as our business for the last year has, in a general way, shown a heavy increase, and the line of inquiry seems to have widened out, it strikes us that the prospects are still growing better and better, and that there is nothing in the way of good times from now on. To this idea, based largely on our own affairs, we have the added weight of our acquaintance in similar lines, all tending to show the same general opinion.

Peru Electric Manufacturing Company, Peru, Ind.. The outlook for our business was never better than now. With our new line of electrical specialties, we are enabled to interest the supply men all over the country. Our factory has been run to its utmost capacity for some weeks past, and we are to-day breaking ground for a new building and greater kiln capacity. We are expecting a largely increased business during the ensuing year, and are putting ourselves in position to handle it.

Stromberg-Carlson Telephone Manufacturing Company, Chicago: This company has experienced a steady growth during the year. The constantly increasing business, which forced it to move from Clinton street to the present location at the beginning of the year, has recently compelled it to greatly add to its space. For the starting of the new year the company has a large number of orders for reëquipping exchanges, besides the furnishing of complete exchange equipments through the southern states.

Kester Electric Company, Terre Haute, Ind.: Business of the year was very satisfactory, and except for the extremely low prices prevailing the volume would have been greater than in 1896. The small margin of profits on sales have prevented the granting of long time credits, and in consequence collections have been easy. The last 60 days have shown a marked increase in both orders and number of inquiries received, and we think the business outlook for 1898 is as bright as any time within the last five years.

Partridge Carbon Company, Sandusky, Ohio: It has been a busy year with us. Our output has been about one-third more than in any previous year. The new year finds us entering into a new field. After experimenting for over two years, we have at last succeeded in producing an electric light carbon equal to any imported [illegible]. We are now putting in place special machinery for [illegible] manufacture of these goods. The outlook for '98 [illegible] very promising in all branches of the electrical trade [illegible] which we are interested.

Leschen-Macomber Whyte Company, Chicago. Our business in the electrical line for 1897 has been more than [illegible] before, and almost double that for the year 1896. We are receiving numerous inquiries daily for electrical material, particularly in telephone and electric light construction, and we believe that the coming year will be one to be remembered in this line of business. We beg to call your attention, as well as that of the trade, to the fact that we have issued a very fine calendar for 1898 which will be mailed upon application.

Crown Woven Wire Brush Company, Salem, Mass.: We have had [illegible] trade the last few months. We sold 25 per cent more [illegible] during the month of November than [illegible] other month since we have been in business. [illegible] started well and the outlook for a good [illegible] favorable. Woven wire [illegible] and more popular every day. [illegible] are coming from the West. We feel that [illegible] growing better slowly but surely, and that [illegible] will boom in 1898.

Roth Bros. & Co., Chicago: Our principal business is the manufacture of [illegible] for isolated lighting and power plants, and [illegible] at which [illegible] manufacturer of other product [illegible], our business takes on immediately. While the year 1897 in aggregate was a fairly good year for us, we much [illegible] that we never enjoyed a steady run of orders, but [illegible] seemed to come in jerks. For two or three [illegible] business would fairly boom, while the following [illegible] or two might be called a dead letter as far as business was concerned. However, we could feel that toward the end of the year orders became more regular and were placed with considerably more confidence. October, and especially November and December, have shown up exceedingly well. In fact, business has taken on to such an extent the latter part of the year that we were forced to add more machinery to our plant and employ extra help to keep up with orders. This leads us to believe that the year 1898 will prove a promising year in our line, and one of the best we have experienced for some time.

K. & W. Company, Pittsfield, Mass.: We have had a successful and satisfactory year, and during the year have increased our capital stock for the purpose of going into the incandescent lamp business. Salem M. Hardy, who is an old and experienced incandescent lamp manufacturer, has entered the company, and we have equipped the factory with all modern improvements for manufacturing a high-grade incandescent lamp. We are now running a full force in all departments and are having a most satisfactory trade in lamps, with a large number of orders on hand.

Electric Arc Light Company, New York: This company has enjoyed the most successful year in its history. The Pioneer enclosed arc lamp has been adopted by many of the largest mercantile houses and lighting plants in the country, and has also been introduced in many foreign lands. During the year we have improved the lamp in many details and have doubled the manufacturing facilities, and are now able to produce a thousand lamps per month. Many orders are already booked for delivery after New Years, and the prospects for the future are very bright for the Pioneer lamp.

Farr Telephone and Construction Supply Company, Chicago: The year has been the most successful in the history of our company. We have been favored with orders from every state in the Union, and besides have done business with customers in many foreign countries who have heard of our products. During the coming year expect to do even a larger business than in the past. We consider the business outlook exceptionally bright. We are removing to the ground floor of the fourteen-story building at 357 Dearborn street, where we will have more room and more elegant quarters.

Cutter Electrical and Manufacturing Company, Philadelphia: The outlook for the coming year could hardly be better. Light, heat and power companies are being established all over the country, and are only exceeded in number by the trolley lines, which will open up new fields and increase business in old ones. Traction, too, abroad is just beginning to make itself felt, and we Americans will get our share of the required equipments; and power transmission—but we are too busy to enumerate. We look for good business all along the line.

Swarts Metal Refining Company, Chicago: We found the electrical trade considerably improved last year; in fact, we note a marked improvement over the previous year, both in our sales of supplies and purchases of scrap material. The increase in the accumulation of scrap material by the electrical plants is no doubt due to the fact that there has been considerable repairing and remodeling through the line. As for the prospects in the coming year, we see nothing to interfere with the improvement over the past year. We are looking for more business, and hope our expectations may be realized.

Nungesser Electric Battery Company, Cleveland, Ohio: Our business has steadily increased since last January, our October and November business of this year being more than double that for the same months of 1896. December sales are most satisfactory and the outlook very encouraging for the future. While collections have been a little backward in some quarters, the aggregate has been very fair. We are so confident that these improved conditions are permanent, we are preparing to double the capacity of our factory. Certainly, if our business is any criterion to judge from, prosperity with a big P has come to stay.

Central Manufacturing Company, Chattanooga, Tenn.: Business just at this time is rather off, as usual, but we have gotten ourselves in position to fill all orders promptly, and are expecting things to pick up shortly after the holidays. Still, we cannot complain, as we have done fairly well. Among the special orders filled this year we mention the power plant at Mechanicville, N. Y., the pins for the Lachine Rapids plant at Montreal, pins for the power plant at Butte, Mont., and for the Montana Power company. We also furnished the materials for the Niagara Falls and Buffalo power transmission line, and several others.

Missouri Telephone Manufacturing Company, St. Louis: The business of the year 1897 has more than met with our expectations. Since April last our business has almost tripled itself. We have been obliged even to increase our facilities to a great extent, and although prices are somewhat lower, we feel perfectly satisfied. From present appearances we should judge that the business for the year to come will be good. There seems to be a decided movement throughout the telephone field for the extension of lines and the building of exchanges, and unless all signs fail, business for 1898 will be even larger in volume than 1897.

Michigan Electric Company, Detroit: We have had a very satisfactory business during 1897, particularly so during the latter half of the year, the business of the first part having been a little below our average for previous years, while for the last part it has been much in excess of same, thus indicating plainly to us the general return of business confidence and action. Our business is now better than ever before and is extremely active in all departments, and we confidently look forward to the year 1898 as one in which we will share with the general business community in the large volume of business which we feel sure will be transacted.

Bossert Electric Construction Company, Utica, N. Y.: Our business has largely increased during the past year and is now eminently satisfactory. Our factory is running to its full capacity and we are frequently working overtime to fill our orders. With the renewed activity in business which seems general in its nature, and which has already made its influence felt in the building trades, and from the general interest which insurance men and others are taking in safer and better methods of electric light wiring, we cannot but feel pleased at the prospects for the sale of our steel boxes, which have met with general approval, and we expect a busy time in 1898.

Card Electric Company, Mansfield, O.: The year just closing has witnessed a substantial advance in recovery from the distressing conditions of 1895 and 1896 and a largely increased volume of general business, in which the electrical industries have secured and enjoyed their full share. The early months of the year were characterized by fluctuations in the demand for manufactured goods, owing to uncertainty in the minds of many of our people as to the actual return of prosperous times; but confidence has steadily grown, and in view of the results already attained, as shown in widely published statistical reports and the multiplied facts of minor or local importance which come under the observation of every observing man, there would seem to be no reason why any citizen of enterprise and business capacity should hesitate to commit himself and his business interests to "that tide which taken at its flood leads on to fortune." Not the least convincing of these indications is the evident intention in every quarter to take some forward step, early in the new year, in the direction of enlarged facilities for production, which is shown in the inquiries continually received looking forward to contracts in the early weeks of 1898. Barring war with foreign nations or other unforeseen and improbable contingencies, there is the strongest assurance of very large and reasonably profitable business in all lines of trade in 1898.

K. McLennan & Co., Chicago: The year with us was an epoch in itself. It marked the change of Gales's commutator compound from a specialty to a staple article; from an article used by a few plants to one of general use, until at the close of the year it is in regular use by nearly every power plant and central station in the United States and Canada, and to be found for sale in every supply house. In the past year we have established agencies in Sweden, Norway, England, France, Germany, Italy and Japan. By the aid of advertising in the Western Electrician the name of Gale is now known to every user of a dynamo or motor. Our expectation for the future is to gather in the few power plants which are not now using our compound.

Boiler Expurgator Company, Chicago: We have exceeded the probable trade looked for in 1897, both in Holm's Tesoline commutator compound and the expurgator. The protective tariff has given some industries an advance to the detriment of some others, which will from the first of this coming year to its close attract considerable capital. The general market in unprotected industries will show an advance over that of the year. The protected industries have naturally attracted the leading enterprise of the country, and this deprived other industries of their pro rata share of enterprise. The end of this year will probably show a more equitable scale for commodities in general, without which even protected articles must fail of their proper home markets.

Lindsley Brothers, Menominee, Mich.: The demand for poles during the last season has been in every way satisfactory to us. We have sold more telephone poles, 20, 25 and 30 foot lengths, than we have ever sold before in any one year. The demand for this class of poles has been unprecedented, showing that telephone construction work has been very active. We anticipate a more active demand for telephone and electric light poles for 1898 than in 1897. Everything indicates greater activity in this line so far this fall. We find the demand in the South increasing every year; more so than in the West. The only fault that we find with trade is that we cannot get better prices for our product, as all other industries in this line are receiving increased prices over last year.

Partrick & Carter Company, Philadelphia: The year now drawing to a close has been a satisfactory one to us. Collections have improved to a marked degree as compared with 1896. There has been a decided increase in the demand for supplies, the most gratifying feature of which is that buyers are showing more conservatism and using better judgment than was the rule during the years preceding the late business depression. These reasons alone are cause for congratulation. As to the future we are very hopeful, and believe that the rising of the sun of prosperity can be hastened and its brightness intensified by the dispersion of war clouds, a settlement of the currency question and the enactment of a national bankruptcy law which will be just to the creditor and debtor alike.

Ohio Electric Specialty Manufacturing Company, Troy, Ohio: We are highly elated over the business we have done during the last six months and look forward to the coming year with somewhat of eager expectancy. There has been a decided improvement in our different branches recently, owing to the starting up of plants which have experienced enforced idleness during the period of depression. We have been compelled to run extra hours right along, and our business has been so gratifying and so overtaxed our capacity that we have had to curtail our advertising and to hold back for the time being a number of new specialties which we intend to place on the market. Everything considered, we are of the opinion that the coming year will be one of renewed prosperity all along the line.

Wheeler Reflector Company, Boston: It is perfectly clear that we have stepped over the threshold of better times and may with confidence look for that gradual and general increase of business that must result from the continual development of new territory through enlarged agricultural, mining and manufacturing operations. This company has no reason to complain of not getting its share of business in the year just past. Its orders have come not alone from all parts of the United States, but from the whole world over, and it has no misgivings about receiving increasing demands for its goods in the future. This is inevitable, when pace is kept with demands incident to every improvement in the lighting field and when attention is invariably paid to maintenance of quality at lowest living prices consistent therewith.

Rawson Electric Company, Elyria, Ohio: Generally speaking, we believe all manufacturers are looking forward to '98 with cheerfulness. There are special reasons, however, why manufacturers of high-class telephone apparatus may feel especially hopeful. With the Bell "Berliner bugbear" removed from a legitimate business, ample capital is being attracted to the very promising fields of telephone extension. Add to the demand for public exchange purposes the constantly increasing call from progressive manufacturing and professional men, and there can be but one result, i. e., an extraordinary demand for electrical telephone apparatus; but the manufacturer who expects to secure and hold his share of this increased business must furnish good goods. Not "how cheap," but "how good and durable," will be the burden of the inquiries for 1898.

General Electric Company, Schenectady, N. Y.: The business of this company during 1897 has been of an extremely reassuring character in every branch—lighting, supplies, railway, motor and mill equipment, mining and power transmission. We consider that in view of the extremely slow convalescence of general business, we have received a larger share than might have been expected or was estimated at the beginning of the year. The facilities of our factories have been taxed to cope with the orders which have come pouring in, and we have found it necessary to extend the area of our factories and increase the general facilities to take care of the increased business now and in the future. To go into details would occupy too much space, but it may be said that every department of the General Electric company has shown a decided increase; in some, of course, more than in others. The sales of our electric lighting apparatus, as well as our railway apparatus, have been continuously good throughout the year, and while large installations have not been numerous, the call for supplies has been unprecedented. In the electric mining field the use of electricity to drive pumps, blowers, hoists, etc., and to run locomotives has also shown an encouraging growth. There are no less than 75 electric locomotives of our manufacture now in operation in the mines of this coun-

try, each an active missionary to mines still operated by other methods. Our long-distance transmission work has also assumed very large proportions; up to date over 100,000 horse power of exclusively power transmission apparatus of our manufacture has been installed or contracted for. Our foreign business extends to every quarter of the globe. Our apparatus is sold purely on its merits and finds a ready acceptance at the hands of the foreigner. With our long experience we are able to parallel almost any case in a foreign country with one in our own. The prospect for 1898 is encouraging, and in view of the large increase in our business, as foretold by existing signs, we are making the necessary preparations to cope with it.

Shelby Electric Company, Shelby, Ohio: The business outlook for the manufacture of incandescent lamps seems to be very bright. We have had a constantly increasing trade that has made it necessary for us to run nights ever since the latter part of August. There seems to be a gradual changing of the lighting systems, with a tendency toward higher voltages. The greatest evidence we have of it is the constantly growing demand for our 220-volt lamps. We are making a great specialty of lamps in high voltages, and anticipate that others will have to do the same some time in the near future. If the increase in the number of lighting plants continues as it has during the last few years, the capacity of every lamp factory in the United States will have to be doubled in a very short time. We feel that we are getting our share of the trade and have nothing to complain of.

Gordon-Burnham Battery Company, New York: The returns for October, November and December are in the neighborhood of 100 per cent. better than during the corresponding months of 1896. In the matter of collections we do not find any improvement. There seems to be a general disposition to increase stocks, which of course reflects in sales. The business of our company, however, can scarcely be considered as a criterion upon which to base judgment of the general business in the electrical field, inasmuch as the bulk of the goods manufactured by us are new to the public and it necessarily requires a great deal of missionary work in order to introduce them. As this work has been in progress in the neighborhood of two years, we would naturally feel the effects in an improved output. We look forward to the new year with optimistic feelings and are convinced that 1898 will show a business as compared with 1897 from three to four fold.

Central Telephone and Electric Company, St. Louis: The demand for goods in our line has been very satisfactory in the past year, and collections likewise; but as the demand has been constantly increasing, we look forward to the next year as being the best that has ever been in this line of the electrical industry. When telephones were first offered at an outright sale the principal purchasers were large companies, composed of bankers and capitalists; then the merchants became interested, and now a large demand for our goods is from farmers. As an instance of the diversified classes of people in the telephone line, we may mention that we have one firm as a customer which is composed of an Indian and white man and has employed a negro to take carge of the exchange. Thus you can see the field in our line is widening until we can say the world is our territory, and under these circumstances the manufacturer offering the best inducements is assured of plenty of business for the year 1898.

Elwell-Parker Electric Company of America, Cleveland, Ohio: The last year has been one of expectation and hope not altogether deferred, and, as regards the last few weeks, there has been a distinct improvement. Of course, in a manufacturing business like ours, a return to good times is not felt as soon as it is in some other directions. The improvement already apparent in the "general primary industries" has already begun to affect the electrical line and appears to us to amply justify expectation of a sound and very considerable improvement in our line of business, as well as in general business, for the coming year. There is one feature in the present conditions that is not altogether satisfactory. It is the prices, that are the result of what we may term a frantic competition. This feature, however, we expect to see improved by a considerable increase in the volume of electrical business done, and, concurrently, improvement in methods and means of production and marketing of products.

W. C. Sterling & Son, Monroe, Mich.: Our cedar pole business for the past year has been the best in years. We have sold poles, cross-arms and pins to electric light, street railway and more independent telephone companies than ever before, shipping as far west as Colorado, south to Texas, and east to New York, and north through Canada. The independent telephone movement is gaining ground and greatly helps our business, although competition is strong. We have recently opened three yards in new territory and are prepared to handle a large number of poles the coming year. We are members of the board of directors of the large New State Telephone company and of the Detroit Switchboard and Telephone Construction company, which has built the largest independent telephone exchange in the world, and we are in deep sympathy with the movement and are furthering such interests whenever possible. We wish to see a combination of all the independent telephone companies so as to connect all cities with toll lines, as the Bell company now does, and our company is moving in that direction throughout this state.

Electrical Exchange, Chicago: The last year has been somewhat more satisfactory than the previous year, and the general feeling has been encouraging all through the year. The increase in the volume of business during the last few months has been especially remarkable. Many of the contracts which electric lighting companies held, or now hold, have expired or are about to expire, thus creating a demand for additional apparatus. The street railway trade in our line was very satisfactory during the summer, but at this season of the year but few street railway companies are making any improvements, although we predict a good trade in this branch of our business during the coming spring and summer. Many of the roads are contemplating extensions and improvements, and a great many lines will be constructed during the coming year. In fact, there seems to be no limit to the increase in mileage of street railways all over the country. We believe that the prospect in store for the coming year is as bright or brighter than for some time past. We expect to do fully twice as much business in the coming twelve months as we have done in those just passed.

Brush Electric Company, Schenectady, N. Y.: The business for the past year with us has been infinitely better in all respects than in the two years previous. We have sold more apparatus and have received promptly our pay therefor. Isolated electric light plants and local companies are being enlarged throughout the country. We hardly know of an electric light company that has not some plan, definitely or indefinitely formed, for rebuilding its station and increasing the amount of its apparatus and putting its properties in better condition. The above, of course, means a large amount of business for us and for others. Capital, however, is much more timid than it was in 1892, but if the "powers that be" in Washington give the country a rest and do not agitate capital by tariff, financial and other useless legislation, capital will get over its scare, and a large amount of it will be invested in electrical industries of every kind and description. We have great confidence in the administration, believe that it understands thoroughly what is best for the interests of the country, and that great wisdom will be displayed in giving us a conservative government. If this be done, then nothing in the past will be equal to the development of the electrical business during the next two or three years.

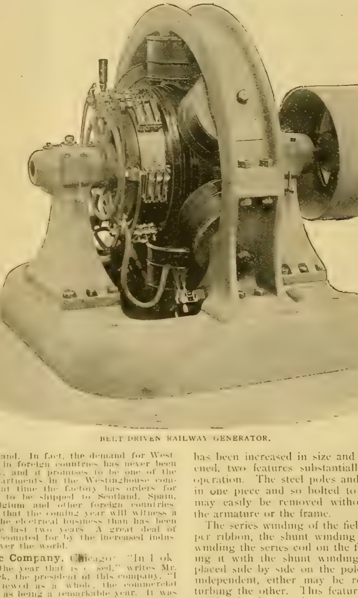
Westinghouse Electric and Manufacturing Company, Pittsburg: While the electrical business of the past two years has not been particularly flourishing with the companies in general, this company has obtained some of the most important contracts for electrical apparatus that were ever made. Among these the contract from the St. Lawrence Construction company is of special interest, not only for its size, but also owing to the interesting features of the work for which the apparatus is to be used. The contract calls for fifteen 5,000 horse power generators, to be installed near Massena, on the St. Lawrence River in the northern part of New York, where the St. Lawrence Construction company is about to utilize the falls of the St. Lawrence River in driving these machines and transmitting electric power to the surrounding districts to be used for manufacturing purposes. Another important contract is an additional order from the Cataract Construction company for five more 5,000 horse power generators for the Niagara Falls power plant, of the same pattern as the three now in operation, which were installed by the Westinghouse company during the last two or three years. The contract for the electrical and mechanical equipment for the Boston new terminal station was another important order, and certain features connected with it make it specially interesting. This feature lies in the fact that the entire work was intrusted to the allied Westinghouse interests, for the reason that they are the only concerns in this country in a position to take charge of such work and complete it without the subletting of any contracts to other firms. The Westinghouse company also obtained a very large contract for mechanical equipment and electric lighting machinery in London, England. In fact, the demand for Westinghouse machinery in foreign countries has never been so great as recently, and it promises to be one of the most important departments in the Westinghouse company. At the present time the factory has orders for apparatus which is to be shipped to Scotland, Spain, Siam, Havana, Belgium and other foreign countries. This would indicate that the coming year will witness a greater activity in the electrical business than has been observed during the last two years. A great deal of this, no doubt, is accounted for by the increased industrial prospects all over the world.

Central Electric Company, Chicago: "In looking backward over the year that is closed," writes Mr. George A. McKinlock, the president of this company, "I think, when it is viewed as a whole, the commercial world will regard it as being a remarkable year. It was in some respects a crucial year, as it started out after a long and disastrous period of depression with exaggerated, although natural, promises of prosperity. There had been developed in the minds of all classes the idea that all that was necessary to do was practically to push the button and the wheels of industry would hum rapidly and sweetly, regardless of the fact that the machine was so weakened by its long period of inactivity that it was not in a condition to admit of its being operated at its maximum capacity. The experience during the year was profitable, and now the country is somewhat in the position of a giant refreshed with new wine. The causes contributing to this happy condition are about us. We have an administration that enjoys the confidence of the business world, we have in our esteemed townsman, the secretary of the treasury, one who is able, wise and competent to deal with the problems which require solution. We have had a bountiful harvest, with surplus food products sufficient to supply the requirements of other less favored countries, which has enabled the western agriculturalist to pay off his mortgages by the ton; also a trade balance in our favor constantly on the increase, and a tariff which will soon supply us with revenue sufficient to meet the expenses of government and protect our gold reserve until such time as the currency problem is solved, when the bugaboo of the gold reserve will cease to plague us. The development of our iron and steel industries has surprised ourselves as well as wrought consternation in the ranks of foreign manufacturers. In our own particular field of electrical development and manufacture, speaking generally, our trade is broadening and we are beginning to be felt in foreign markets. The large foreign contracts that have been placed with our electrical manufacturers have had a beneficial effect in helping us to appreciate our resources as manufacturers. In the electrical supply trade, the whole tendency, in my judgment, is encouraging, and the outlook promising for not only a larger business but a more profitable business. Jobbers in electrical supplies have about concluded that the electrical supply trade conditions are no different than other legitimate lines, and are awakening to the fact that the buyer in the past has had altogether the best of it, and that taking orders for glory is along the same path as other glory seekers traverse, and which, we are told, leads to the (commercial) grave. This lesson, judging from all the signs of the times, seems to have been well learned, and if kept in mind, will result, I confidently believe, in 1898 being the most satisfactory year the trade will have experienced."

Belt-driven Railway Generator.

Many cases exist in which the conditions do not warrant the installation of direct-connected apparatus, and to these cases the belt-driven generator is more applicable. Improvements in these generators have kept pace with those in all other classes of electrical apparatus, and the distinguishing features of excellence of the General Electric company's direct-connected apparatus have been incorporated in its new line of belted machines. These are all six-pole generators, built in five sizes ranging from 110 kilowatts to 500 kilowatts. The illustration shows a 110 kilowatt, six-pole, 500 revolution machine.

The magnet frame is of cast-steel heavily ribbed, making it both light and compact. Its magnetic efficiency is the highest obtainable. The bearings are built upon the ball and socket principle; are self-aligning and self-oiling. The armature shaft



BELT DRIVEN RAILWAY GENERATOR.

has been increased in size and the bearings lengthened, two features substantially guaranteeing cool operation. The steel poles and pole-pieces are cast in one piece and so bolted to the frame that they may easily be removed without disturbing either the armature or the frame.

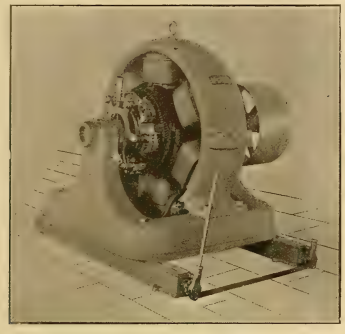
The series winding of the field coils is of flat copper ribbon, the shunt winding of wire. Instead of winding the series coil on the field spool and covering it with the shunt winding, both windings are placed side by side on the pole, and being entirely independent, either may be removed without disturbing the other. This feature will be greatly appreciated when it is compared with the methods heretofore in use. It is no longer necessary with this new method to remove the shunt winding to reach the series winding.

The armature is of the barrel-wound type, such as is used on the General Electric direct-connected generators. This method of winding gives the smallest number of joints, and facilitates any necessary repairs, as few coils need to be removed to reach any particular one incapacitated for service. The cast iron flange, bolted to the armature spider at each end of the core, forms a support as well as a cylindrical receptacle for the projecting ends of the coils. The coils are secured firmly in the slots of the core, and the cross connections are made on the [illegible] flange. The projecting ends of the coils [illegible] flange are thoroughly insulated and held [illegible] by steel bands. The flange extension also [illegible] the windings from any oil that may be thrown [illegible] the bearings. The surface of the [illegible] armature is perfectly smooth, offering no [illegible] nity for the collection of oil or dust.

Ventilation is effected by the use of [illegible] structed vanes forming air ducts between [illegible] nae of the core. These convert the [illegible] into a blower, and create a strong draft through [illegible] windings. The commutator leads are [illegible] directly

from the coil to the segment immediately beneath it The construction of the commutator is similar to that of the direct-connected machines. It is ventilated by air drawn through the body and discharged through air ducts in the core. The small difference of potential between the segments secures the permanence of the insulation and freedom from sparking.

The strength of the magnetic field in these generators is so proportioned to the armature reaction that

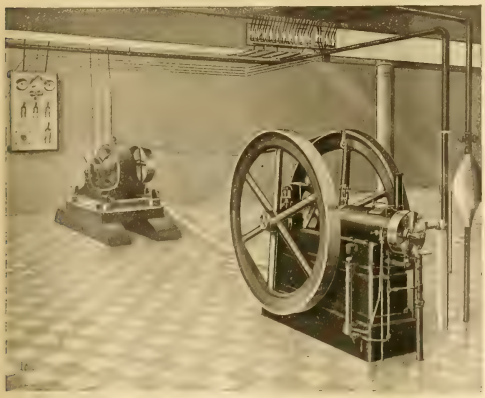


NEW AKRON MULTIPOLAR APPARATUS.

a constant brush lead and neutral point are insured even with heavy overloads.

Fairbanks-Morse Gas and Gasoline Engine.

The use of a gas or gasoline engine for electric lighting is a most satisfactory method of illuminating private residences, stores, clubs, hotels, etc. The chief advantages of this system are economy, simplicity and convenience. The Fairbanks-Morse engines have been thoroughly perfected, and a new type, called the "special electric engine," illustrated herewith, has been placed upon the market. This type is especially designed for furnishing power for electric light plants by either belting directly to



A FAIRBANKS-MORSE GAS AND GASOLINE ENGINE.

the dynamo or by direct coupling to the engine shaft to the armature shaft of the dynamo. These special electric [illegible] governing, being [illegible] in controlling the [illegible] respond to the work demanded. The cost of furnishing such [illegible] by Fairbanks, Morse & Co. to be about one-fifth what would be charged by an electric company for furnishing the same number of lights. Many of these plant have been installed and the [illegible] be giving most excellent satisfaction, both as to services rendered, economy of operation and convenience of the system. Plants are in operation that are furnishing from 50 to 500 incandescent lights, and reference to the letters in the circulars of the manufacturers will fully explain what satisfactory service they are performing.

As generally figured, when lights are furnished by an electric lighting company the average charge is one cent for one 16 candle power lamp for each hour, and when the Fairbanks-Morse gas or gasoline engine is used, with gas for fuel at 50 cents per 1,000 feet or gasoline at the average price, five 16 candle power lamps, the company states, can be furnished for one hour for one cent. When the gas fuel costs $1 per 1,000 feet the cost per lamp for one hour would be in direct proportion to the increased cost in fuel over the 50 cents per 1,000 basis.

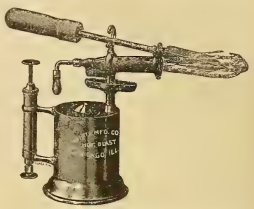
Fairbanks, Morse & Co. invite those interested to visit their warerooms in Chicago, corner of Monroe and Franklin streets, and inspect the electric lighting plant which is operated by a 15 horse power special electric gas engine.

Combination Hot Blast Blow Torch.

The accompanying cut illustrates a new torch now being placed on the market by the White Manufacturing company of Chicago. It is called by the maker a combination hot blast blow torch, and is a new and powerful generator for heating by gasoline. It is in reality three useful tools in one, combining a soldering iron heater, a painter's and electrician's torch, and a paint burner. The soldering iron attachment is the most valuable feature of this torch, as it makes it thoroughly adapted for electricians, as well as useful in outside work, such as conduit building, joint wiping, etc. This torch gives a perfect blue flame estimated at 1,500 degrees Fahrenheit.

New Akron Multipolar Apparatus.

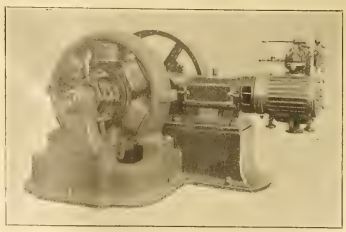
Many special features are incorporated in the new Akron multipolar apparatus manufactured by the Akron Electrical Manufacturing company of Akron, O., which is herewith illustrated. The dynamo has a cast-iron field yoke with laminated steel magnet cores and soft steel pole shoes, thereby giving ideal magnetic and structural conditions. The lami-



COMBINATION HOT BLAST BLOW TORCH.

nated cores, having a great capacity for magnetism, respond readily to the magnetizing influences of the coils encircling them, while the cast-iron makes a perfect welded joint between the cores and yoke, and the yoke has a sufficient cross-section to add beauty to the design as well as rigidity to the whole frame, at the same time using only metal enough to provide for the magnetic circuit required. The soft steel pole-shoes distribute the magnetic lines evenly over the armature, while the cross-section of the magnet cores is reduced as much as is compatible with efficient results, thereby reducing the copper losses in the field as much as possible. The armature is built up of fine laminations of soft steel divided into three or more sections by small brass spacers having radial arms to create a blast of air through the core openings thus formed and across

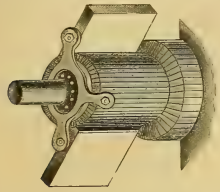
NEW AKRON MULTIPOLAR APPARATUS.



NEW AKRON MULTIPOLAR APPARATUS.

the armature winding. The spider which carries this core is of cast iron with radial arms so arranged as to exhaust air freely through the ends and force it outward through the passages formed by the spacers and the end flanges, which have also radial passages for the air. This construction so ventilates the armature as to increase the radiating capacity enormously and keep the temperature down far below the normal practice, thus allowing of heavy and continued overloads without injury to the dynamo. The machine formed coils of the armature are first perfectly formed, then insulated by hand and imbedded in troughs made of mica, paper and pres-

board in the armature slots. The commutator is made up of drop forged copper bars, with the best India mica insulations, and put together at high temperatures and under enormous pressure, so that it is impossible to move the bars when once they are assembled and turned true. The current is taken off by radial-feed carbon brushes, with large bearing surfaces on the commutator, which contributes to make them run almost noiselessly and cool. They are connected at the top by means of flexible copper strips to the brush-holder's body, thus making a positive metallic circuit from the commutator to the dynamo's terminals, and the highly polished brass holders also add materially to the beauty of the apparatus. On the belted units the bearings are self-oiling and self-aligning, securely held in pedestals cast integral with the base frames.



LE VALLEY VITAE CARBON BRUSH

They are also provided with sliding base rails having convenient ratchet screws attached to tighten and loosen the belt. Taken as a whole, the generators are neat and pleasing in design, thorough in construction, and so conservatively rated that, it is claimed, they may be operated continuously under 25 per cent. overload with temperatures not exceeding 50° C. above the surrounding atmosphere, and with temporary overloads of 50 per cent. without injury in any way. They are made for direct-connected, slow and moderate speeds, and average in size from three-fourths kilowatt up to 300 kilowatts in the generator, and from one horse power to 400 horse power in the motor size.

Bullock Generators and Motors.

During the last few months the Bullock Electric Manufacturing company of Cincinnati has placed several new machines upon the market, all of which have been received with marked favor. One of the latest types is the engine-generator, which has attracted particular attention, on account of its superiority of workmanship and finish. Another is the Bullock motor of the enclosed type E, class, shown in Fig. 1. This motor was designed espe-

FIG. 1. BULLOCK GENERATORS AND MOTORS.

cially for a line-shaft motor, but it can be used in any connection. It was planned to occupy as small a space as possible and still give the maximum power. It is a very neat and compact machine and is protected from dirt and dust. These motors are in use in the large pressrooms of New York.

An order has just been filed with the company for an 80 horse power motor to be directly connected to the new press which is being installed in the New York World office, and will be the largest printing press in existence. The Bullock company has also received the order for the entire equipment of Armour's new plant in South Omaha, which will be entirely operated by electricity, both for power and lighting, and will be the largest establishment of this kind in this country where electricity is used exclusively. There will be 22 motors used in this plant, and this will reduce the use of shafting and belting to a minimum; a saving of power and space which all manufactures can appreciate. The first generator for this plant has just been shipped.

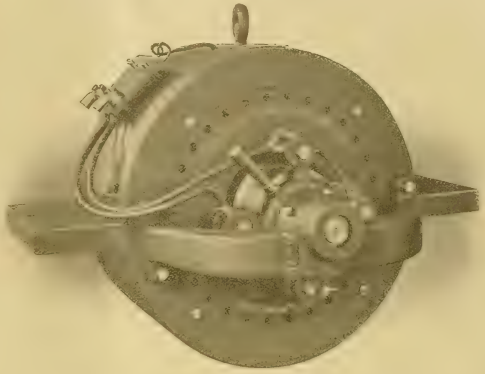


FIG 2. BULLOCK GENERATORS AND MOTORS.

It is a 200 kilowatt compound wound, eight pole machine. It has ventilated windings, self-oiling bearings, laminated pole-pieces and slotted armatures. It is machine-formed and has removable field and armature coils. All these machines are guaranteed to be free from electrical and mechanical defects and are not allowed to leave the factory until they have been tested for hours under varying loads and have run sparklessly, showing perfect regulation through this test.

Fig. 2 is a motor for direct connection to all web printing presses.

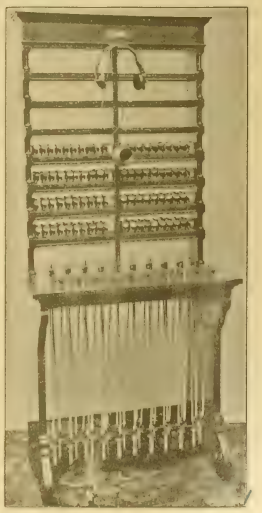
The shops of the Bullock company are unable to turn out machines fast enough to keep pace with the orders, and the company has now decided to change their location to some situation where a more extensive factory may be built. As soon as

Le Valley Vitae Carbon Brush.

The Le Valley Vitae carbon brush, for [illegible] generators and motors, is [illegible] treated carbon brush. No [illegible] is employed in the treatment and in connecting the segment up so commutators will not collect dirt or grime. In the treatment the gases are entirely extracted leaving the carbon open for treatment, then it is put through a [illegible] process which enables the brush to [illegible] constantly and uniformly, as it slowly wears away, preserving at all times an even, bright and polished surface. The company uses the word Vitae, because of the claim that it is the only brush made that properly lubricates the commutator, keeping it cool, never sparking under varying load, and therefore insuring at least treble the ordinary life to both commutator and brushes, and insuring also from seven to

to degrees cooler temperature than any other brush manufactured. The claim is also made that it is a lower resistance brush and has greater conductivity, conveying the entire current without loss, and also that it wears perfectly smooth. It neither crumbles nor breaks and requires no attention.

The Le Valley Vitae Carbon Brush company, the



[illegible] manufacturing [illegible] a compound which [illegible] commutator will keep all sparking and prevent wear of the commutator bars, the [illegible] brushes [illegible] and [illegible] the [illegible] brush. The company is located at [illegible] Liberty street New York.

Central Switchboard.

The Central Electric and [illegible] at Lewis, Me., has just perfected [illegible] switchboard [illegible] the [illegible] conductors [illegible] any

switchboard on the market, and also to possess the advantage of being built on the increase plan, whereby the purchaser may select a cabinet of sufficient capacity to accommodate as many drops as he may consider will possibly be needed and have installed only the number of drops actually needed to start with.

The drops and spring-jacks are placed on each shelf and the purchaser has as many shelves filled as desired. When increase is necessary vacant shelves, which are detachable, may be sent to the factory, filled and placed in the cabinet by the most inexperienced person.

Each drop is composed of two coils wound to resistances which equalize the drawing power of both magnets. This is especially desirable where long lines are connected to switchboards, as it requires but little power to create magnetism in these drops, and with the drawing of both magnets an indicator may be dropped when the call is made over much longer lines than can be successfully attached to the majority of switchboards. All drops are so placed that when indicators are raised no part of the drops projects in front of the spring-jacks; therefore, an operator cannot, by accident, drop an indicator while connecting cords.

Each spring-jack is directly beneath the indicator of the drop to which it is connected, so that the operator has only to look once when the call is made and can plug in and raise the indicator with one hand at the same time.

One of the greatest advantages possessed by this switchboard is in the plug connections. Each set of plugs is composed of a long and short plug. The short plug is inserted in the spring-jack of the line calling, which connects the subscriber directly to operator's transmitter and receiver. As gravity batteries are used for transmitter, no receiver switch-hook is necessary to open or close the battery circuit. When the operator is informed of line wanted, he leaves the short plug in the spring-jack of the subscriber calling and takes the long plug of the same set and inserts it in the spring-jack of the line wanted. This plug automatically cuts out the drop and connects the generator directly to line, thus leaving absolutely no resistance in switchboard for generator current to overcome, and on this account calls from the switchboard may be made over even longer lines than the same generator would ring if connected in magneto bell on a telephone. As soon as subscriber wanted has been called, the operator throws the knife-switch in front of the plugs to the opposite side, and both cords are then in the same circuit and all parts of switchboard are cut out with the exception of one drop, which remains in circuit for the purpose of notifying the operator when conversation is finished. Any short plug may be used for the listening plug if desired.

The entire space occupied by 100 drops and spring is only 20 inches by 24 inches, and a board of 200 drops may be arranged so that one operator could reach each drop and spring-jack without leaving the chair. Each drop is distinct, and as the line wire is connected to the binding post in the rear of each drop, there is no mass of wires connecting various parts of the switchboard.

Each cabinet is furnished with a perfection long-distance granular carbon transmitter, mounted in short nickel-plated adjustable arm, which is attached to the cabinet directly in front of where the operator will sit. The cabinets for switchboards are made from seasoned cherry wood, which is highly polished

Philadelphia Trolley Accident.

An accident on a trolley line in Philadelphia recently resulted in a serious injury to several passengers. A car was descending the steep grade on Leverington avenue, leading to the Philadelphia and Reading railway tracks, when the brakes refused to act, and despite the large quantity of sand poured on the slippery rails, the car shot down the incline, gathering momentum at every foot. The motorman worked at the brakes and sand-box and the conductor was called to his assistance, but their combined efforts failed to check the flying car.

Just below Silverwood street another car stood waiting to transfer passengers on the approaching car for the Pennsylvania station. The motorman of the waiting car saw the runaway car, but too late even to release the brakes on his own car. It jumped the rails at the Silverwood street turn and was hurled with great force partly against the front of the "dinky" and partly against a lamppost and fireplug standing at the curb.

The motorman was thrown from the waiting car and escaped with a few bruises, but the crew of the runaway were not so fortunate. The conductor was the chief victim. His right arm and leg were crushed and torn. The motorman was also terribly cut on the head and arms. Of the passengers on the runaway car none escaped injury. The wreck took fire from the heater, and one of the cars was destroyed completely.

One Effect of Long-distance Telephony.

An interesting statement is attributed to President S. R. Callaway of the Lake Shore and Michigan Southern railway. "For some time," Mr. Callaway says, "railroad men have been trying to find the reason why, in spite of the fact that business is increasing, especially in the transportation of freight, the passenger business is languishing. After figuring on the matter for some time we have come to the conclusion that the long-distance telephone is responsible. Business men are using it more and more, and the way it is cutting into our passenger business is a very serious matter to us."

CORRESPONDENCE.

New York Notes.

New York, December 27.—Telephone exchange girls will be interested in the fact that one, at least, of their number was generously remembered by patrons of the company on Christmas. Miss Bertha Sherwood, local operator in Port Chester for the New York Telephone company, is the young lady so honored. She says that a coachman stopped at her home before breakfast and delivered an envelope containing a $100 bill. The man hurriedly mounted the box and drove away, saying that he was under instructions not to disclose the name of the giver. On reaching the office Miss Sherwood found $5 from the Fire Department, $5 from a transportation company and $10 from "Cash." A diamond hatpin, eight yards of blue serge cloth, a set of silver nutpicks, eight boxes of candies and a case of champagne arrived at intervals during the day. The Republican headquarters in the recent Congress and county campaigns were in Port Chester, and Miss Sherwood thinks that the politicians who kept her busy all summer, and caused her to lose her vacation, have been seized with remorse and made the gifts as a recompense.

A decision has been handed down by Justice McLaughlin in the Supreme Court against the Electric Power company in a suit against the city to recover damages for the removal and destruction of its wires. The suit involves the question of the right of the city to remove wires from over housetops after having served notice on the company that such wires must be placed in subway conduits. Justice McLaughlin says that the company obtained the right to put up wires under the express condition that they were subject to the control of the city, and that they should be placed in subways. In asking the court to hold that the subway plan in certain designated streets was not feasible the justice says that the company is asking the court to override the will of the people. The question of danger, Justice McLaughlin says, is not worthy of consideration.

William Houston Kenyon, who has been elected chairman of the Committee of Fifty-three which is preparing the way for the new organization of Republicans of this city, is one of the leading patent lawyers of New York. He is a partner in the legal firm of Witter & Kenyon. Mr. Kenyon has been identified with many of the most important patent causes which have arisen within the last 15 years, among them being the telephone cases, the Brush electric arc lamp and dynamo and storage-battery cases, the Edison electric incandescent lamp litigation, the Bate refrigerator contest, and latterly the trolley suits.

Permission has been granted the Metropolitan Street Railway company of this city, by the State Railroad Commission, to adopt the underground electric trolley system as a motive power on that portion of the New York and Harlem railroad leased by the Metropolitan on Thirty-fourth street, from Second avenue to the Long Island ferry. In consequence of the large number of cars of the several lines making terminals at the ferry in East Thirty-fourth street, the Railroad Commission has advised the Metropolitan company that sufficient flagmen, trackmen and safety devices on the cars must be provided to guarantee the safety of passengers and pedestrians. Permission has been granted the Second Avenue Railroad company of New York city to adopt the underground trolley system on that portion of its line on Ninety-sixth street between First and Second avenues.

The Sun says that while it is not true that the Metropolitan and Third Avenue Railroad companies have consolidated, "it is true that the companies have buried the hatchet, and will stop suing and enjoining each other." It is said that amicable adjustment of present and future differences is contemplated. Each line will be permitted to extend itself in natural directions, under municipal supervision, without opposition from the other company. This will do away with the opposition of the Metropolitan interests to the Kingsbridge [illegible] of the Third avenue line as well as with the [illegible] tion of the Third Avenue company to the Metropolitan company introducing the electric system into Park row or putting in the electric conduits under the tracks of the Third avenue [illegible] Grand and Broome streets. These latter electric connection will be made as soon as the engineers of the two companies can agree on the best plan. The new arrangement will be in no sense a consolidation of the roads, and each will continue to operate its lines independent of the other.

M. S.

PERSONAL.

A. T. Clark, treasurer of the American Circular Loom company of 620 Atlantic avenue, Boston, was a Chicago visitor during the holidays

The retirement of N. C. Hawks and Philip M. Reynolds from the Anchor Electric company of Boston is announced. Mr. Hawks was president and Mr. Reynolds treasurer of the Anchor company.

According to a dispatch from New York, Professor Alexander Melville Bell, the distinguished scientist of Edinburg, Scotland, and the father of Alexander Graham Bell, the inventor of the telephone, will wed Mrs. H. G. Shelby of Toronto in New York within the next two weeks. The exact date of the marriage has not yet been fixed, it is said, and the place of the ceremony is to be kept a secret, as it is desired that the wedding shall be private.

Gossip concerning the affairs of the Chicago City Railway company is now quite generally to the effect that General Manager M. K. Bowen will be elevated to the presidency of the company at the annual meeting to be held shortly. The Chicago Chronicle says: "Up to this time Joseph Leiter, D. G. Hamilton and Mr. Bowen have been about even favorites in the guessing as to who would succeed President Wheeler on his retirement, but it is now claimed the Leiter interest is supporting Bowen for the place, and it is claimed the latter has sufficient backing to secure his election to the important position. Of course, a change in plans may occur before the holding of the annual meeting." A gentleman familiar with the situation said last week that if Mr. Wheeler desired a re-election he would certainly continue at the head of the corporation.

ELECTRIC LIGHTING.

The sale of the Commonwealth electric ordinance last week is announced, but there seems to be some doubt as to the identity of the purchaser. The opinion prevails that an agreement has been reached between the Chicago Edison company and the Walsh interests, by which the privileges of this franchise are to be shared. It is well known that these interests are working together, but a formal consolidation is not expected.

The Laramie Electric, Gas Light and Fuel company of Laramie Wyo., is in the market for two 12 by 12 self-oiling engines and two directly connected 50 kilowatt generators of the latest design. It is also its intention to re-wire the municipal system for 15 arc lamps and 100 incandescent lamps, to be supplied from the incandescent circuit. No change will be made in the domestic system except to connect the new generators with the wires of the domestic system, and thus relieve the old engines and dynamos of part of their load.

The electric light company of Bedford City, Va., has notified the council of that city that it would not renew the contract expiring January 1st, under which it furnished the town lights at $70 per year, but would be compelled to charge $80. The company also submitted a proposition to turn over the plant to the town for six or twelve months on condition that the property be kept in good condition and the interest on $12,500 mortgage bonds at five per cent. paid during the time the plant was under the town's control. The light question has been a bone of contention for some time, and it was decided about eight months ago to put oil lamps in, and the lamps were purchased, but changes having been made in the personnel of the council, the lamps were sent back, and a contract made with the light company at $70 until January 1st.

ELECTRICAL SECURITIES.

The Edison Electric Illuminating company of New York has declared a quarterly dividend of 1½ per cent., payable February 1st.

The Westinghouse Electric and Manufacturing company has declared a quarterly dividend of 1¾ per cent. on its preferred stock, payable January 3d.

The Belle City Electric Street Railway company of Racine, Wis., which was sold to bondholders July 20th for $150,000 and was reorganized, has executed a $250,000 mortgage to the Illinois Trust and Savings Bank, Chicago, which will act as trustee on the company's bonds.

Part of the $1,000,000 Corrigan consolidated street railway first mortgage five per cent. bonds have been called for redemption. This railway is a part of the Metropolitan system of Kansas City, a large interest in which is owned by Chicago capital. The bonds will be paid at the offices of the Central Trust company of New York at the rate of $1,100 per bond.

The North Shore Traction company of Boston reports gross earnings for November of $105,481, an increase of $3,103 as compared with the same month of last year, and net $36,880, a decrease of $1,422. For the [illegible] months ended November 30th the gross earnings were $1,342,281, an increase of $6[illegible] as compared with the corresponding period of last year, and net $[illegible]70,621, an increase of $6,932.

The governing committee of the New York Stock Exchange has listed the Brooklyn Rapid Transit company's additional issue of five per cent. 50 year gold bonds, $1,217,000, making total amount listed $6,308,000. These bonds are issued for the purchase of a controlling interest in the Sea View Railroad company, $37,500 first mortgage bonds of that company and bonds of the Brooklyn, Queens County and Suburban Railroad company.

Subscriptions are asked at $40 per share, ex the

January dividend, for 60,000 shares of the five per cent. cumulative preferred stock of the United Traction company of Pittsburg. The amount offered is the total of the preferred stock, the par value of which is $50 per share, and at the price offered it yields 6¼ per cent. The United Traction company is a consolidation of practically all of the street railroads of Pittsburg, and it operates 117 miles in Pittsburg and neighboring cities, under a franchise running for 999 years. According to the statistics of operation furnished by the company, the lines composing the system earned prior to the consolidation a sufficient amount to pay the interest on all obligations and the dividend upon the preferred stock. Within the five months since the consolidation the net earnings in excess of fixed charges and the dividend upon the preferred stock were $28,270.

TELEGRAPH.

The Western Union Telegraph company has petitioned the Federal Court for three months' time before being forced to separate its property from the Union Pacific. The petition asserts that the purchasers of the Union Pacific are not yet even known, as the purchasing committee is the only known responsible head. The separation cannot be made until the Kansas Pacific is sold.

ELECTRIC RAILWAYS.

The building of the Bluff City electric street railway at Highland Park, Ill., has been stopped. The Thompson estate has secured an injunction restraining the road from further construction work in front of a piece of its property.

At the annual meeting of the Birmingham Railway and Electric company at Birmingham, Ala., recently, Col. A. M. Shook was elected president; Robert Jemison, first vice-president; William A. Walker, second vice-president, and John B. McClary, general manger.

By a curious coincidence about 50 of the Metropolitan elevated trains of Chicago undertook to start at the same instant on Monday. The demand for current was more than the power house could respond to. The effort to comply disabled three out of the four engines, it is said, and the number of trains was decreased until repairs were made.

By a unanimous vote of the Chicago City Council an ordinance granting one year extension of time to the Northwestern Elevated Railroad company was passed Wednesday evening, December 29th. This gives the Yerkes company until January 1, 1899, to complete the construction of the road and have it in operation. Thus, the $3,500,000 bond deal which hung in the balance pending the disposition of this ordinance may now be said to be safely landed.

The burning of the Coliseum in Chicago affected Alley "L" stock slightly, the quotations before and after the fire being 62⅝ and 61⅛ respectively. The idea, of course, is that a good source of business is gone. However, traffic returns are most encouraging Last week was the largest since the close of the World's Fair. The total number of passengers carried was 437,738, or a daily average of 62,534. This is 5,761 ahead of the daily record for the week ended December 19th. The big gain was, of course, due very largely to the rush of travel occasioned by the Chirstmas shopping.

In explaining a rear-end collision at the Twelfth street station on Monday, General Manager Hopkins of the Chicago South Side elevated railroad said: "The accident could not have happened if we had not been obliged temporarily to discontinue the block system of signals on account of the alterations made in changing from steam to electricity. We will soon have our electric cars running. Our power house at Fortieth and State streets is completed, we have the third rails laid and one-third of the cars delivered. All we have to do now is to get the rest of the cars and set up our machinery. I think we will be able to make our trial trip about March 1st."

TRADE NEWS.

The Murray Iron Works company of Burlington, Iowa, has begun suit against R. G. Dun & Co. for $20,000 damages alleged to have been sustained through the publication of an erroneous statement affecting the credit of the plaintiff.

To newspaper men the "compliments of the season" from the Joseph Dixon Crucible company of Jersey City, N. J., are particularly appropriate and always appreciated. A box of the excellent Dixon lead-pencils directs attention to the undisputed fact that all the graphite products of the company are of the highest quality.

Judging from the holiday sample of the Monarch incandescent lamp sent out by the Western Electrical Supply company of St. Louis, the product must be of unusual excellence. By personal test it is known that the sample is a good one, while the Monarch lamps generally are guaranteed to burn as evenly, with a brighter light, and to give much longer service than the sample. It may be stated that the sample lamp has a cigar for a filament. The idea is very cleverly carried out and results in the combination of a good cigar in a good lamp from a good company.

The Otto Gas Engine Works of Philadelphia, which produces the well-known "Otto" gas engines, has plenty of orders on hand, and the management reports that business is particularly good at this time. The company has recently installed two 110 horse power engines in Sisterville, W. Va., for electric lighting purposes, and has also made an installation in Mannington, W. Va.

The Hope Electric Appliance company of Providence, R.I., reports that the capital stock is increased from $60,000 to $100,000, in order to meet the large increase in business. The demand has far exceeded the company's ability to manufacture. The Hope company's instantaneous single and double-throw switches have recently been the subject of a special circular from the National Board of Fire Underwriters.

V. E. Raggio, the energetic representative of the Commercial Electrical Supply company of St. Louis, who devotes his attention to Texas, spent Christmas in Chicago. Mr. Raggio reports a rapidly growing interest in Texas and other southwestern states in all electrical matters, and predicts a continued increase in the prosperity of that section. The Commercial company has many friends in that country and the number is being daily increased through Mr. Raggio's aggressive work and business-like methods.

The M. C. Bullock Manufacturing company of Chicago reports that it has, within the last few months, furnished power for nearly 1,700 2,000 candle power lights—mainly 125-light machines, direct-coupled to central-valve engines. The company builds a vertical engine, either compound or triple-expansion, with three cranks set at 120°, which, when direct-coupled to two 125-light machines, make a compact 250-light set. The actual floor space taken by both engines and dynamos is a little less than 100 square feet, or a trifle under four-tenths of a square foot of floor space per lamp. It is evident, therefore, that the proposal of this company to furnish one 2,000 candle power lamp for each square foot of floor space is entirely safe. The company reports that high economy is nearly always demanded, and a number of the engines installed for this work are triple-expansion condensing, using high-pressure steam and guaranteed to use less than 13 pounds of steam per indicated horse power hour. Among recent orders the M. C. Bullock Manufacturing company reports three 200 horse power triple-expansion condensing engines for the Nichols Chemical company of New York. These engines are to run 30 to 90 days under full load without closing the throttle. This make four engines furnished to this company for this service within the last year. Another recent order was for a 100 horse power compound for Spofford & Mills of Chicago to furnish power for electric lights in their new building. This is popularly known as the Boston restaurant plant, and, like everything else in the building, is being fitted up in very attractive shape. The dynamo is of the Western Electric type, and the combined set is exceedingly compact and neat in appearance.

BUSINESS.

The American Rheostat company of Milwaukee has opened a Chicago office at 1104 Rookery building with a full and complete line of rheostats for all purposes. The George Cutter company will represent the American company in this city.

The McFell Electric company, Chicago, is making a strong bid for construction and repair work and is pushing its telephone business. As is well known, the company handles the famous Ericsson Swedish telephones. The McFell company has earned an excellent reputation in the trade and has made several exceptionally inte sting installations.

Calendars for 1898 have been received by the Western Electrician from the Leschen-Macomber-Whyte company, 19 and 21 South Canal street, Chicago; American Electrical Works, Phillipsdale, R. I.; Menominee Electric and Mechanical company, Menominee, Mich.; Paper Mills' company, Chicago, and the New York Life Insurance company.

Take your choice over Pennsylvania Short Lines. Trains leave Chicago union station 10 a. m. and 8:15 p. m. daily. Passengers on morning train arrive Jacksonville second evening, and on night train early second morning. Tourist tickets to leading resorts in Florida and the southern states, with return limit covering the entire season Ascertain particulars by addressing H. R. Dering, assistant general passenger agent, 248 South Clark street, Chicago.

The Electric Appliance company is congratulating itself upon the great record that is being made by O. K. weather-proof wire. Although this wire has been on the market for about 10 years, it is stated that there is not a single recorded case where the insulation has not given the best of satisfaction. O. K. weather-proof insulation has never been known to come off of the wire, and wherever used the insulation is good and hard after five or 10 years of service. With this insulation, it is pointed out that a line with the insulation hanging in shreds or strings is an impossibility, as the insulation is put on in such a way that it is next to impossible for it to strip off. O. K. wire costs no more than other brands and is deservedly popular.

The Electric Railway Equipment company of Cincinnati, O., reports that business has improved wonderfully in the last few months. Its steel tubular pole department has been working day and night since last September manufacturing poles for electric railways and arc lighting. The brass foundry is also working day and night, and the company has secured some large contracts for railway supplies. Its new mast arm, with automatic cut-out, is claimed to be the best on the market, and the company will be glad to correspond with anyone in want of arc lamp mast arms.

George W. Patterson has recently been appointed western representative in charge of the well-known office of the American Circular Loom company, at 1114 Marquette building, Chicago. Mr. Patterson is known to the trade as western agent for the Gordon-Burnham and Law primary and Ohio storage batteries, and Medbery knife switches and overhead railway material, which he will still represent. Mr. Patterson reports business good for the season, but regrets it is not fashionable to make Christmas presents of anything in his line; however, the demand still continues for his business card showing "Periods When to Make Money."

Hugo Reisinger of New York makes the following statement: "I wish to inform the trade that the word 'Electra' has been properly registered by me as my trademark and therefore cannot be used by anybody else without infringing on my rights. The 'Electra' carbons are made, as heretofore, by C. Conradty, Nuernberg, who owns not only the oldest, but the most extensive carbon works in existence, and whose carbons remain unequaled in quality and efficiency, having become the standard for electric lighting the world over. As to parties reported as makers of 'Electra' carbons, I wish to state that I have brought suit against them for having misused the trademark 'Electra,' and that they have been enjoined by the Nuernberg courts from making any carbons stamped 'Electra,' under penalty of 100 marks for each carbon. I shall guard the interest of buyers of my carbons as heretofore, and any information in regard to infringements on the registered trademark 'Electra' that will enable me to take legal proceedings will be gratefuly received."

The Raster Carbon Rheostat company wishes to call attention to its new resistances, which can be used for starting boxes, regulating resistances, rheostats for arc lamps, testing of alternating dynamos and car-heating apparatus. Their superiority lies in the use of special carbons instead of wire. The carbons are imbedded in an insulating substance, which absorbs and dissipates the heat, serves as a protection from outside influences, is absolutely fireproof, and never heats to such an extent as to char wood or any other material, when in service. The advantages of such resistances, after thorough experimenting, have been found to be that they cannot burn out like wire coils, when overloaded; they allow the selection of larger cross-sections, because of their high resistance and afford greater capacity and durability; they are the only resistances not subjected to induction currents, and therefore the only practical instruments, excepting lampboard rheostats, for tests with alternating dynamos, and they retain an almost equal resistance whether hot or cold. They are incased in a handsome iron box with a face-plate. The starting boxes safely permit a continuous current of two minutes, as against the outside limit of 30 seconds, allowed by makers of wire resistances. Furthermore, they are provided with an automatic release. All resistances are tested with an overload of 25 per cent., and starting boxes in particular must carry a current of 25 per cent. above their guaranteed capacity for two consecutive minutes before they are pronounced perfect.

The Ohio Electric Specialty Manufacturing company calls attention to the many features of superiority of the woven wire brush. It was at first thought that the brush must of necessity be made of copper cloth, but that has been found to be both practically and theoretically wrong. The Ohio Electric Specialty Manufacturing company of Troy, O., is putting out an improved article and claims to have remedied the defects of the early types The company sends brushes out on trial with the privilege of returning them at its expense. The brush, it is said, cannot spread out on the commutator owing to its peculiar construction. It is made of gauze and is superior to copper, as it reduces the friction and necessarily the heat in the armature. It is lubricated and does away with the use of compounds on the commutator. It is made flexible as the buyer desires, either longitudinally laterally or both. It will adjust itself to any irregularity in the commutator The brush is [illegible] a remarkable sale, considering the time it [illegible] on the market, and can be purchased of [illegible] leading supply houses. The Ohio Electric [illegible] Manufacturing company is also making [illegible] other high-grade specialties, including the [illegible] rheostats and Rogers lubricant, for use on machine where the use of a commutator lubricant is imperative. Samples of the Perfection dynamo brush, with descriptive circulars and prices, can be procured from the Ohio Electric Specialty Manufacturing company, Troy, Ohio.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 21, 1897

595,[illegible]. Suspension [illegible] Electric Cables. George [illegible] Cambridge, Boston, Mass. Application filed July 24, 1897.

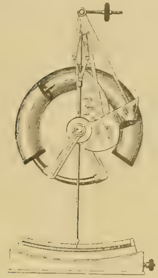
A cable hanger consisting of a [illegible] and a flexible insulating cord [illegible] and adapted to be wound around a cable.

595,695. Electric Accumulator. Clovis P. F. Clerc and Adolphe G. Pingault, Paris, France. Application filed December 5, 1896. Patented in Belgium August 8, 1896.

Essential features are plates carrying active material, perforated non-inductive coverings surrounding the plates on their sides and bottoms whereby when plates and coverings are lifted out any active material which may have become loosened from the plates will be taken out also; an insulating cell inclosing the parts, an inclosing case having a cover, a cut-out or similar sheet on the lower side of the cover, the sheet and cover pressing against the end of the cell and forming a cover for it also.

595,731. Electric Motor. Maurice B. Pengnet, Cambridge, Mass. Application filed March 31, 1897.

A portable electric motor for small work is combined with a plurality of independent tool-engaging means rigidly secured thereto, so that the motor and tool-engaging means constitute one rigid structure, individual tool-engaging means being driven at different rates of speed by the motor.



NO. 595,751

595,751. Wattmeter. Ernest K. Adams, New York, N. Y. Application filed September 11, 1897.

The wattmeter has an arm capable of displacements proportional to logarithms of the number of watts in the circuit to be measured, an index or marker and means for converting the displacements of the arm into displacements of the index or pointer proportionate to the number of watt.

595,768. Electric Controlling Device for Paper-feeding Machines. Talbot C. Dexter, Pearl River, N. Y., and Clarence Ransom, Jersey City, N. J. Application filed September 16, 1896.

The [illegible] an electrically controlled paper-feeding device, a double-armed electric contact lever supported above the path of the paper upon suitable bearings and [illegible] grooved insulated block supported [illegible] the plane of feed of the paper, one arm of the contact lever resting in the groove of the block in the path of the paper and adapted to be moved out of the groove by [illegible] into which the other of the arms dips.

595,777. [illegible] Hamburg, Germany. Application filed November 16, 1896.

[illegible]

595,80[illegible]. [illegible] Application [illegible]

An [illegible] electric contact [illegible] act to [illegible] contact point [illegible] arm to [illegible] position.

595,821. Method [illegible] and Apparatus [illegible] Meters. [illegible] Washington, D. C. [illegible] 27, 1897.

The [illegible] device [illegible] parate from [illegible] the other [illegible] the ground.

595,827. [illegible] Brooklyn, N. Y. [illegible] 1897.

A device [illegible] adapted to be [illegible] for the [illegible] movable [illegible] mently mounted [illegible] relatively to [illegible] ment.

[illegible],841. Electric Motor. [illegible] cago, Ill. Application filed [illegible]

An electric motor having [illegible] with a greater number of [illegible]

current flowing in one direction than for the current flowing in the opposite direction is one of the features.

595,842. Circuit-closing Device for Burglar Alarms. Elmer E. Wilson, Blackwood, N. J. Application filed August 18, 1897.

Claim is made for a plate having an opening therein, a spring secured at one end to the plate, a cam pivoted to the other end of the spring and projecting through the opening, a contact piece having one limb secured to but electrically insulated from the plate, and its other limb adapted to be in contact with the cam when the latter is raised by an upward movement of a sash, and an electric circuit having an alarm therein and connections with the contact piece and plate.

595,868. Reversing and Cutting-out Switch for Electric Motors. Thorsten von Zweigbergk, Cleveland, Ohio. Application filed September 20, 1897.

A reversing switch is described, having two homologous series of contact plates, one of the series having consecutive plates connected together and the other series having alternate plates connected together, and two series of contact fingers, each series adapted to engage with either series of contact plates, the relative disposition of the contact plates and fingers being such that when one series of contact fingers is in engagement with one series of plates the other series of contact fingers is in engagement with the other series of plates, there being provision for relative movement between the contact plates and contact fingers.

595,871. Electric Burglar and Fire Alarm. Charles J. Bukoutz, Lamoille, Ill. Application filed April 19, 1897.

This is an automatic system, comprising a telephone call provided with a shaft and crank-arm, a spool or drum loosely mounted on the shaft and provided with a cord and weight, a removable pin, a pivoted pawl adapted to project into the path of the arm and the spring connected to the pawl, in combination with the combustible cord having one end fixed to the pawl and the other end connected to a door, window or other suitable point within the premises.

595,874. Electric Elevator. Augustus L. Duwelius, Cincinnati, Ohio. Application filed February 18, 1892.

One of the features described is a field magnet governor, consisting of a shaft, a carrier mounted thereon, weights of sector form pivoted to the carrier, an end-thrust guided by the carrier, an equalizer thereon and a connection between the equalizer and each of the weights.

595,887. High-tension Switch. Hermann Müller, Nuremberg, Germany. Application filed June 2, 1897.

This switch consists of groups of contact rollers made from easily oxidizable non-arcing metal, the groups of rollers being mounted on spring-arms, each roller being normally out of contact with the others, and means for forcing the rollers into contact with each other, while simultaneously a turning motion is imparted to the same.

595,898. Electric Motor. Fenner E. Whipple and Charles A. Stauffer, Philadelphia, Pa. Application filed May 1, 1896.

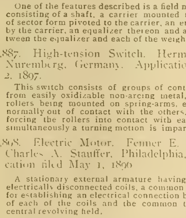
A stationary external armature having three or more electrically disconnected coils, a common terminal, means for establishing an electrical connection between one end of each of the coils and the common terminal, and a central revolving field.

595,936. Electric Arc Lamp. Antoine Blahnik, Paris, France. Application filed July 10, 1896. Patented in France February 4, 1896.

In a regulating apparatus for arc lamps there is the combination with a pulley, of two rotary disks formed of magnetic metal and eccentrically supported on each side of the pulley, a flexible band lying upon the peripheries of the pulley and disks, means for applying tension to the band and an electro-magnet and armature arranged to exert attraction on the disks proportioned to the variations in the current intensity.

595,963. Electric Burglar Alarm. David W. McCaughey, Chicago, Ill. Application filed November 27, 1896.

The device consists of the combination of a terminal or contact point, a longitudinally movable insulating block in which it is mounted, a hard metallic sleeve for protecting one end of the insulating block, and another hard metallic tube in which the parts are mounted for protecting the same.



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body portion extending beyond the shouldered portion, a terminal mounted against the face of the shouldered portion, and a threaded terminal mounted upon the end of the extending body portion.

595,983. Telephone Repeater. William H. M. Weaver, Macon, Ga. Application filed September 4, 1897.

The cut illustrates a telephone repeater, comprising two or more stations, each equipped with a receiver and an induction coil transmitter, intermediate repeating devices comprising two receivers and two induction coils, with their primary wires extended to and provided with contact devices operated by the diaphragms of the receivers of the repeating devices, each receiver and induction coil of the repeating devices being in the main-line circuit of one station and a common return circuit connecting the main circuit at each station at a point between its receiver and transmitter, with the main circuit between the receivers and induction coils of the repeating devices, and also connecting the main circuits between the receiver and induction coil of one side of the repeating devices with the main circuit between the receiver and induction coil on the other side of the repeating devices.

596,002. Electrical Transmission of Energy. Rudolph M. Hunter, Philadelphia, Pa. Original application filed November 9, 1887. Divided and this application filed July 28, 1891.

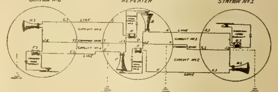
The system comprises means for generating currents of electricity of high tension, a line circuit leading therefrom to a distant place, induction apparatus for reducing potential of the line currents, a local circuit supplied with the low-tension induced currents from the induction apparatus, translating or current-consuming devices arranged in the local circuit, an induction coil having its coarse wire connected with the local circuit and in parallel with the translating or current-consuming devices, and a high-tension circuit connected with the fine wire of the induction coil and supplying current to a second local circuit insulated from the other.

596,012. Prepayment Coin-controlled Mechanism for Electric Meters. William F. Browne, New York, N. Y. Application filed October 2, 1897.

The combination is described of an electric meter, a rotary coin-pocket wheel and suitable gearing connecting the wheel with a rotary part of the meter, whereby the wheel will be rotated by the operation of the meter, and a predetermined quantity or volume of current metered to a customer by insertion of a suitable coin in the pocket-wheel.

596,017. Telephony and Telegraphy. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed January 31, 1893. Patented in France September 3, 1891, and in England December 27, 1891.

The method of transmitting messages consists in passing over a line waves of alternating or varying current of such high frequency as only slightly affect the receivers, and modifying the amplitudes of these waves in accordance with the desired message.



NO 595,983.

596,032. Inductor Generator. Pomeroy W. Power, Pittsfield, Mass. Application filed September 10, 1897.

One claim is given: In an inductor generator having two crowns of induced coils on the interior of a cylindrical armature, the combination of a shaft, two inductor portions movably mounted thereon, and bearings for the shaft, the space between either of the parts and the bearing nearest thereto being substantially equal to the length of the induced coils.

596,036. Auxiliary Apparatus for Selective Electrical Signals. George W. Whittemore, Brooklyn, N. Y. Application filed September 2, 1897.

The invention comprises a telephone lock-out appliance comprising the automatic switch lever, in combination with an electro-magnet having two reversely wound or connected coils in branches extending from the main-circuit conductors respectively to a ground connection; a second electro-magnet having a single coil contained in the ground connection, an actuating armature for the double wound electro-magnet, a hook or detent lever attached thereto, an armature or shutter for the single-wound magnet normally held in its forward position by the hook lever, but adapted to move into its backward position when released therefrom by the operation of the actuating armature, and to be restored to its forward position by the direct attraction of the single-wound magnet, and a locking pin carried by the shutter armature and adapted to lock and unlock the switch lever according as the armature is in its backward or forward position.

596,0[illegible]. Electrical Transmission of Energy. Rudolph M. Hunter, Philadelphia, Pa. Original application filed February [illegible] 3, 1883. Divided and this application filed October 4, 1889.

A line conductor conveys high-tension currents of alternately rising and falling potential; a variable resistance is in the line circuit, an induction coil having its fine wire in circuit with the line, a local circuit including the coarse wire of the induction coil and a transmitting device in the local circuit consisting of an electro-magnet to vary variable resistance.

[illegible]. Transmission of Electrical Energy. Rudolph M. Hunter, Philadelphia, Pa. Original application filed June 18, 1887. Divided and this application filed April 20, 1892.

One feature is a secondary generator for electrical transmission of energy, consisting of the combination of a fine-wire coil, a line circuit including the fine-wire coil, an interrupter for the current passing through the fine-wire coil and a coarse-wire coil wound parallel to the fine-wire coil, and a local circuit including the coarse-wire coil.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, JANUARY 8, 1898. No. 2

Electrical Features of the Greater New York Celebration.

The cities of New York and Brooklyn and many smaller communities in the immediate vicinity ceased to exist as separate corporations on the stroke of midnight, December 31, 1897, and were merged into Greater New York, which was ushered in with due ceremony on January 1, 1898. It was a remarkable event and was without a parallel in history. The new municipality is the second city of the world in population and area, and in many respects surpasses all other communities.

The consolidation was fittingly celebrated by a public demonstration that has already received so much attention that the details are familiar to newspaper readers the world over. There were many features of interest to the electrical fraternity, however, which may be mentioned here with propriety.

The celebration began with a monster parade, which was formed in Union Square and marched down Broadway to City Hall Park. The line of march was brilliantly illuminated, many of the large establishments making a considerable display in the sky was dark and rain was falling during most of the time occupied in the celebration.

Interest centered about the City Hall, which had been gorgeously decorated for the occasion. Bunting and flags were resplendent with incandescent lamps, and every detail of the building as well as the decorations was brought out distinctly by 36 searchlights whose beams were turned upon the official headquarters of the new municipality. The picture on this page, which was made from a photograph taken

ELECTRICAL FEATURES OF THE GREATER NEW YORK CELEBRATION.

which electric lighting played an important part. In the parade itself there were many electrical features, the decorative effects of the electric lights upon the floats attracting general attention and provoking much favorable comment. One float carried a big tiger, his mouth aglow with electric lights, and a pretty girl—"The Lady and the Tiger"—beside him. Above were pictures of Richard Croker, Mayor Van Wyck and John F. Carroll, brilliantly lighted. Another float represented the Statue of Liberty in the middle of a big fountain, on which was inscribed "Meet me at the fountain." This float was drawn by 12 gray horses, with an electric light on the saddle of each. The effect was pretty. In the bicycle division one wheelman represented the Brooklyn bridge in electric lights. Half a dozen American District Telegraph messengers on wheels had a place in the line. Searchlights placed at frequent intervals along the line of march were turned upon the procession, thus affording the spectators in the upper windows of the office buildings an opportunity to witness the parade.

When the head of the procession reached City Hall Park and turned across the Plaza it was greeted with a flood of light from all the searchlights in the neighborhood. The dense mass of humanity that was packed into the inclosure before the City Hall presented a unique appearance under the beams of the searchlights. The neighborhood was made as light as noonday by the searchlights, although immediately after midnight, gives an excellent idea of the scene that greeted the spectator. Flags and shields and a huge anchor, all picked out in incandescent lamps, decorated the front of the building, and 250 twin arc lamps in colors were arranged in the park itself and heightened the effect considerably. At each wing was a large national flag in incandescent lights, arranged with longitudinal curves to simulate the floating of the ensign in a breeze and the illusion was completed by the passing across the surface of the flags of a series of shadows, so that one might look at them through narrowed eyelids and be almost persuaded that they were of some luminous fabric, really floating in the wind. Two electric shields of red, white and blue appeared near the center of the building, at either side, and between them, just over the reviewing stand, was a brilliant center piece in the shape of a huge anchor in white incandescent lights. Two strings of incandescent lights formed the halyards of the flagstaff. On top of the building were arranged searchlights which flashed upon the upturned faces of the throng below.

At midnight the climax was reached when the flag was raised over City Hall by the mayor of San Francisco, 3,000 miles away. An electric motor had been placed in the cupola to raise the flag, and precisely at midnight the mayor of San Francisco touched a key closing the circuit between San Francisco and New York and switching the current on the motor. A little ball of white bunting was seen to shoot up the flagpole, and on reaching the top the wind caught it and the flag fluttered in the breeze, while 36 searchlights were turned upon it simultaneously and cheer after cheer arose from the multitude below. It was a memorable occasion and made a lasting impression upon all who witnessed the ceremony.

The preparations for this great display were organized and executed by the New York Journal.

Chicago Electric Traction Company.

The incorporation of the Chicago Electric Traction company last week led to considerable discussion of the possibilities of a combination of the several street-railway corporations of Chicago. The new company has a capital stock of $2,000,000 and a bond issue of $1,500,000, with power to issue further bonds for extensions and additions. The stock and bonds are all owned in Philadelphia and New York. The company has organized under the general railway law of the state, which require that a majority of the directors must live in Illinois. According to the charter, the directors are Samuel R. Shipley, I. L. Rice and Henry Levis of Philadelphia, G. J. Weizlar and J. S. Bache of New York, and Charles R. Holden, Carl Mayer, William L. Tibbs, Thomas A. Moran, Jr., and Alfred S. Austrian, Chicago. The other director is E. R. Gilbert, who will be general manager of the road.

The following statement was given out by Levy Mayer, who directed the organization of the company: "The company is organized to operate a street-railway system in the southern part of the city, as the articles of incorporation state. One of the first steps of the company will be to issue $1,500,000 bonds, with possibly another issue following. It has already bought 12 franchises of roads in the southern part of the city, of which three or four are now in operation. The most important of these is the Englewood and Chicago Electric, running from Sixty-third street south and west, having a trackage of 32 miles leased to the Calumet Electric company. Franchises for further extensions of the system will be asked of the council before a great while."

There is much speculation as to the outcome of the move. By many it is believed that the new company has been organized to consolidate the Hyde South Side suburban roads, the Englewood and Chicago, the Calumet Electric and the South Chicago. The last is said to be controlled by the estate

of the late Columbus R. Cummings, which so far has shown no particular desire to sell its holdings. The Calumet Electric is owned by the National Bank of Illinois, which has put something over $2,600,000 into the line, but is understood to be willing to sell for $2,500,000. The facts that the charter permits the company to operate in all divisions of the city and is under the general railway law of the state are said to mean a great deal more than the consolidation of three suburban roads. It is claimed that Mr. Yerkes is interested, and that by obtaining the General Electric franchise all three suburban roads might get a trunk line downtown and Mr. Yerkes might force the Chicago City Railway company to accept his proposition for a consolidation of surface roads.

Eiffel Tower Struck by Lightning.

The illustration which is herewith reproduced from l'Energie Electrique was made from a photograph taken during a storm in Paris in which the Eiffel Tower was repeatedly struck by lightning. The picture graphically shows the tower looming up in the night with the lightning playing about it.

Northwestern Electrical Association.

Secretary Mercein of the Northwestern Electrical association announces that he has received assurances from Prof. R. B. Owens of the State University of Nebraska that he will present a paper upon "Electricity in Municipal Engineering" at the forthcoming meeting of the organization in Milwaukee. This completes the list of contributions for that event.

EIFFEL TOWER STRUCK BY LIGHTNING.

The committee on entertainment, which is composed of James M. Hill of Chicago, W. L. Church of Milwaukee and Charles Cuno of Oconomowoc, has arranged a very attractive programme of social features, including a theater party and banquet. Mr. Mercein has been selected to preside at the banquet, which will be sufficient to assure the members of an interesting evening.

Mr. Armstrong on Electrical Journalism.

In his review of the electrical progress of the year 1897, in the Chicago Record, Charles G. Armstrong inserts this paragraph:

"I think all engaged in electrical work will agree with me that the most potent factor in the development of this limitless agent has been the high character, the untiring energy exhibited by our various electrical journals. One who has watched their struggles, ever endeavoring to eliminate the chicanery, to expose any attempt of an unprincipled inventor to rob the ever confident public, holding up the hands of the faithful and honest worker, however humble he might be, ever ready to enlighten the public of the [illegible] [illegible] and [illegible], avoiding the [illegible] and the [illegible], cautioning the too ready investor, ever encouraging the legitimate enter[illegible] [illegible] the electrical journal [illegible] done as much as the [illegible] themselves to perfect, to ripen, as it were, into manhood this great industry. I have often wondered what the electrical interests would have done had it not been for the [illegible] enterprise of the electrical journal. Text books have often been valueless. The science has grown so rapidly that before a text book could be written and placed on the market the subject would be trite and the theories outgrown. The machines described therein would no longer have been used, new ones having been devised and placed in their stead. But meantime our faithful journals, week by week and month by month, have kept pace with the rapid trend of affairs."

Multiple-rate Metering.

By Eustace Oxley.

It is not probable that "methods of charging for current" is a subject that will now command the same general interest that has heretofore been shown, both in this country and abroad.

The reading public is growing tired of a discussion that has had little result, except the production of a great variety of conflicting opinions. Still, it is hoped that a question of such importance may not be without interest, provided it can be shown that a long step has been taken in the direction of its solution. A new system of applying the double-rate method of charging has been employed by a large electric lighting corporation in this country for five or six months. Broadly speaking, the method is well known, but its employment in this instance has been under novel conditions. The marked success which has followed, and the results that have been accomplished in solving problems of much importance to all generating companies, will lend interest to a description of the manner in which these ends have been attained.

A rational and satisfactory system of charging for current must accomplish certain results, all of which are essential, though not in the same degree. Prominent among these are three considerations which cannot well be separated: The first is to reduce the cost of generation, the second to extend the adoption of electric energy for heating, lighting, power, and all the uses for which it is so well adapted, and the third to induce all consumers to increase their consumption, economically to themselves and profitably to the generating company. Such a method must have in view the improvement of the load factor of the entire outfit, the mains as well as the generating mechanism. To do this effectively it must hold out strong inducements to all consumers to extend the hours of consumption, and to multiply the purposes for which current is used. It should not discourage an increased demand for current at any hour of the day, but it should not, on the other hand, induce large demands during those hours when the maximum output for lighting occurs. The general aim must be, as Prof. Thomson says, to "smooth out the hills and hollows of the load diagram;" and this can only be done properly by bringing the lower parts of the load curve up to the peak as nearly as possible, instead of lowering the peak itself. Finally, the method must be simple and equitable, to both the company and the consumer. A method that accomplishes all these objects would seem to be as near the ideal as possible. Experience appears to have established a general conviction that the double-rate method, or discounts based upon the time of demand, is best adapted to the main requirements. It has been widely used in different ways, and is simple and logical. To give consumers a discount, or low rate, during all hours save those in which the peak of the load occurs, and a normal or higher rate during the few hours when the maximum number of lamps will be in use, holds out the strongest inducement to the public to substitute electric energy in place of steam for power, and to employ it for many other purposes.

An increased rate during peak hours does not, in any proper sense, discourage increased demands at that time, and, on the other hand, it does not have any tendency to produce such demands. A reduced rate during the remaining hours, at the lowest figures consistent with the proper interests of the generating company, will act as a powerful inducement to the consumers to use current during those hours.

Cooking, heating and many other of the familiar processes of daily life only await the time when their performance by a servant so safe and cleanly can be had at a cost which is not prohibitive. The resulting improvement of the load factor, and the increased efficiency of the generating mechanism, will then reduce the cost of production and enable every part of the mechanism to earn its share of the fixed charges. The reduced expenses, and the larger earnings for the extinguishment of the fixed charges, will go far toward multiplying the profits of long hours' use, even at largely reduced rates. Moreover, it has been repeatedly demonstrated that such increased demand for [illegible], and the resulting improvement in the load factor of the whole outfit, is of itself the means of a great saving in the actual cost of operation.

This matter is too well understood to require any discussion, but as a single example it may be mentioned that at Brighton, England, it was found that an improvement of three per cent in the load factor had the same effect in reducing the total cost of producing electricity as if the coal bill had been reduced 15 per cent, the charge for coal in this case being $5 per ton. The importance of accomplishing results of this nature has been very generally admitted. The difficulties encountered in the use of a double-rate method have been such, however, as to seriously affect its adoption, although a large number of the leading central-station managers regard it as the most complete and simple solution of the problem. The objections urged against it seem to have been due to faults in the means by which the method has been practiced, and not to any defects inherent in the method itself.

Among the devices heretofore proposed, the best

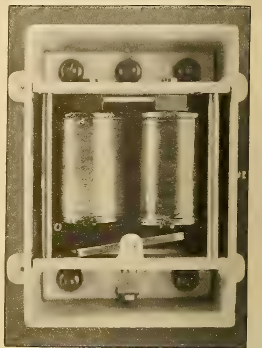


FIG. 1. MULTIPLE-RATE METERING.—CONTROLLER, DOOR REMOVED.

was probably that employing two separate meters, or meter dials, one to register all the current used during the hours when a low rate was charged, and the other to register that used at a higher rate. This required the two meters to act alternately. Their operative alternation was effected by a clock at each point of consumption. The expense of installing such apparatus upon a system of even an average extent would be large, and would materially increase the fixed charges.

But a more serious objection was found in the great liability of clock gearing to stop, or become wholly unreliable, when used to make and break an electric circuit. While this may be overcome to some extent, by using clock gearing of the best manufacture, the evil cannot be entirely eradicated, and the large increase in cost, due to the price of high-grade clock movements, would not be compensated by the removal of the objections against the cheaper grades. The frequent inspections necessary, the numerous removals of clocks for repair and regulation, and the winding and setting of a large number of such clocks, would evidently require an increase in the number of employes.

As one of the chief objects of a system of charging should be to enable the company to reduce the cost of generation, and lower the rates

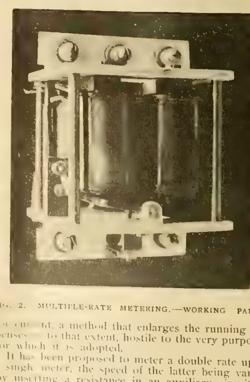


FIG. 2. MULTIPLE-RATE METERING.—WORKING PARTS.

for current, a method that enlarges the running expenses is, to that extent, hostile to the very purposes for which it is adopted.

It has been proposed to meter a double rate upon a single meter, the speed of the latter being varied by inserting a resistance in an auxiliary circuit at the central station. The plan was to connect all the meter shunts with a separate wire, run from the station to the points of consumption, and to vary the voltage on this wire by the insertion of resistance at the central station to regulate the speed

of the meters, so that they should register a part only of the current actually used, during the hours when a low rate was given. One objection to this method is, that the interruption of the auxiliary circuit would cause every meter to stop. A more serious objection, however, is that the necessary drop of voltage upon the separate wire would be likely to seriously impair the accuracy of the results obtained.

A single meter, however, can be used in a manner that removes all objection, and gives accurate registration. By the use of the same form of controller, a resistance can be inserted in each meter circuit, at the hour when the low rate is to begin, and maintained therein until the end of the low-rate period. This resistance is graduated to retard the speed of the meter to a degree representing the ratio the low rate bears to the full rate. When inserted the meter will register only a part of the current that is used. By the insertion of this same resistance at each point of consumption, the provision of an auxiliary circuit is avoided, and no inaccuracy can be produced by a drop in the voltage. This plan has the advantage of economy, by saving the expense of a second meter at each point of consumption. In some instances this saving may be important, and it is of course desirable in all cases. The plan of using two meters, registering alternately, has the merit of simplicity, and is preferred, by the average consumer, who can easily understand it, and calculate the amount of his indebtedness.

The single meters can be connected with the same ease and simplicity as the two separate meters.

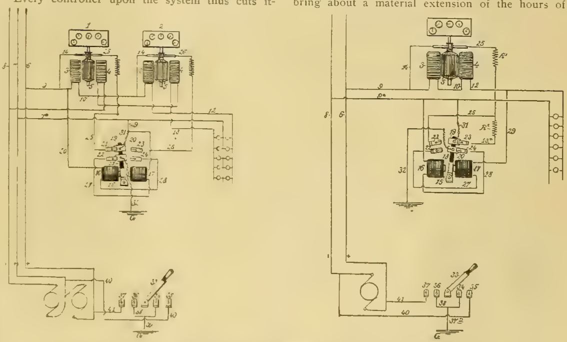
The chief difficulty in the way of the double-rate method, or, as it is sometimes termed, the differential rate, based upon the time of demand, seems to have been the absence of suitable mechanical appliances by which two meters could be duly controlled, one to meter current at a low rate and the other at a full rate and in such a manner as to fully protect the company against fraud, secure accuracy, and avoid any material increase in the fixed charges, due to large outlay for apparatus. A description of the apparatus, and the methods of controlling it, as now installed upon the system of the company using it, may prove interesting:

At each point of consumption is placed a small electro-magnetic controller-switch, which is shown in Figs. 1 and 2. The parts are all enclosed in an aluminum case, 4½ inches in length and 3½ inches in width and depth. The enclosed parts consist of two independent electro-magnets, indicated by the numerals 16 and 17 in the diagram, Fig. 3, and a pivoted arm 18 carrying an armature and knife contacts, and arranged between the electro-magnets. Upon each side of the pivoted arm are two clips, 22 and 24, which clips are connected by wires 27 and 28 to the terminals of the windings of the electro-magnets 16 and 17, the connection for each clip being made with the magnet lying on the other side of the pivoted arm. The second terminals of the windings of the magnets are connected (in a three-wire system) to the positive service wire 9, and the neutral house wire 7^a. Two clips, 21 and 23, one on each side of the pivoted arm 18, form part of the armature circuits of the two meters 1 and 2. These meters are shown in the diagram as being of the high-efficiency type of Thomson wattmeter, and they are connected with the controller at each consumer's premises by a wire led from the middle right-hand binding-post, connecting with the shunt, or armature circuit, to the right-hand terminal at the top of the controller case. This is the only change made in the normal connections. In Thomson meters of other types, not having the extra binding-post, a small hard rubber block is attached to the wooden back piece, between the binding-posts. On this rubber a narrow strip of brass is mounted, having a small screw at each end, to connect with the terminal of the controller, and with one of the armature connections. In meters having shunt circuits, such, for example, as the Edison chemical meters, as well as other types, the manner of connecting the controller is practically the same. In some forms of meters, however, as those provided with a series winding only, a modified construction of the controller is used, by which each meter is wholly disconnected, when its period of registration is terminated. The pivoted arm 18 carries two knife contacts, 19 and 20, one of which is connected to earth, and the other to the neutral house wire. The knife 20, having an earth connection, is struck into one or the other of the two clips, 22 or 24, which connect with the terminals of the two electro-magnets. One of these controllers is placed at each point of consumption. It will be seen that by throwing the pivoted arm 18 to one side, the armature circuit of one meter is opened by the withdrawal of the upper knife, 19, from one of the clips, 21 or 23, while the entrance of the knife in the clip on the other side of the pivoted arm completes the armature circuit of the other meter.

The whole system of meters is controlled from the central station, where a small double-throw switch is placed. Two of its clips, 34 and 36, one on each side of the switch-arm 33, have an earth connection. Clip 37, on one side is connected to the positive, and the clip on the other side is connected to the neutral of the system. When the arm of the switch is closed, or thrown into the clips on one side, the circuit will be from the positive, over the switch-arm 33 and clip 36 to earth, then at each consumer's station, by the lower knife 20 and the switch-arm 18, through the clip 22, in which the knife 20 is lying, thence through the winding of the magnet 17, on the other side of the switch-arm 18, and then to the neutral house wire and main. The switch-arms at all points on the system are by these means thrown simultaneously into the clips, opposite those in which the knives were resting. At the instant when the lower knife on the controller arm withdraws from the clip in which it rests, the circuit of the electro-magnet that produces the movement of the arm is opened at the clip. As the same knife strikes into the corresponding clip on the other side of the controller-arm 18, it completes at that point the circuit of the magnet which will be energized when the switch at the central station is thrown into the two clips opposite those in which the switch was previously closed. An indicator is arranged at the central station, to show at any moment at which rate current is being metered. It consists of two dials, having suitable words inscribed, to denote the difference—"Day" on one and "Night" on the other dial answers the purpose. The two dials are illuminated by lamps, placed behind them, and cut in alternately by the operation of the station switch.

Several things are noticeable in the arrangement described: First, the automatic breaking of the circuit of the electro-magnet, by which the throw of the pivoted arm of the controller is produced, and the completion of the circuit of the other electro-magnet, at the opposite clip, by the same movement of the arm.

Every controller upon the system thus cuts itself out automatically, by the simple movement of the pivoted arm 18.



FIGS 3 AND 4 MULTIPLE-RATE METERING —DIAGRAMS OF CONNECTIONS.

Second, the marked simplicity of construction, and arrangement of parts, by which liability to become disordered and tendency to depreciation are reduced to the minimum.

Third, the extremely brief period that current remains on the control circuit, this interval being measured by the time required after one magnet is energized, to enable the knife 20 to draw out of the clip which forms part of the circuit of that magnet.

Finally—and this feature is the most important of all—the control apparatus throughout the entire system is installed and operated electrically from a single point (the central station), without the trouble and expense of providing a wire, or wires, for the control circuit. This is a feature of no small advantage in any case, but where the mains are not laid in subways and where, as in the Edison system, the wires are piped, and buried beneath heavy block pavements or asphaltum, the labor and cost of laying a control circuit would be very great. Upon the lines of the company where the apparatus is installed, the mains are in conduits in which two disused pressure wires were found, each No. 16, B. & S. gauge, and partly as a matter of convenience one of these wires was used for the circuit, controlling a number of the earlier installations. With others, two circuit wires were connected, the object being to ascertain if there were advantages in one arrangement, as compared with the other. Repeated trials and continuous use, extending over a period of nearly six months, have shown that the accuracy of control and certainty of operation were the same.

Dispensing, therefore, with wires for the control circuit, the cost of installation is reduced to a point so low, that the addition to the fixed charges caused by the complete equipment of a system with the apparatus will be inconsiderable.

The controllers, which practically constitute the entire apparatus, are simple and inexpensive, and are connected and disconnected quickly, and with ease. Each controller takes from one fortieth to one-twentieth of an ampere for its complete operation. The small current and the high resistance of the electro-magnets, which are wound with No. 40 wire, and have 2,000 ohms resistance, or more, render an ordinary resistance, due to a poor ground connection, of no consequence.

The importance of improving the load factor, as the means of reducing the cost of generation, is well established. The necessity of effecting this is evident by the readiness with which many central stations have installed costly accumulators, which have been thought by some to afford a solution of this problem.

Accumulators are valuable, no doubt. They come to the rescue in the event of a break-down; they steady the load; they can supply a sudden large demand for current which happens during peak hours, and in other respects they are useful adjuncts of a central station. Moreover, they improve the load factor of the generating mechanism, but not the load factor of the feeders and mains.

The latter, which may constitute by far the largest part of the investment in systems of ordinary extent, are not affected economically by the presence, or absence, of accumulators. There are, however, objections to them. They are highly expensive; they suffer a loss in efficiency of 25 per cent.; they depreciate rapidly; they occupy much space in the plant; their upkeep is costly, and they require a large outlay of capital with respect to the output.

On the other hand, it has been shown repeatedly what is the advantage of increasing the hours of consumption, and thereby improving the load factor of the entire outfit.

It is only by offering effective inducements, which bring about a material extension of the hours of consumption, largely increase the adoption of electric energy for every purpose for which it can be adopted, and enable it to compete with gas and steam, under conditions of practical equality—thus only that the "hills and hollows of the load curve" can be smoothed out, and the actual cost of production reduced to a point that will remove the incentive for maintaining private plants, and the substitution of gas and incandescent burners in place of the electric light.

In an article by Prof. Marks, of recent publication, a tabulated statement was given, setting forth the results in a given case of increasing the hours of consumption. Among other points shown, it was stated that an incandescent lamp of 16 candle power burned two hours daily cost each year $2.10, and yielded an annual profit of $2.63. If the use be extended to 12 hours daily, the yearly cost would be $7.26, and the yearly profit $21.46. Here the improvement of the load factor, due to an extension of the hours of use from two hours to six times that number, multiplied the annual cost by 3.36 and the yearly profit by 8.16.

It is well understood that the standing charges may constitute at least 85 per cent. of the total annual expenses of a generating plant. The remaining 15 per cent., therefore, represents the yearly running expenses, fuel being in most cases the largest single item. A central station, therefore, can double its output without adding to its expense account more than another 15 per cent.

Prof. Thomson, in speaking of the problems that confront central station managers, says that improving the load diagram is apparently of [illegible] importance to them, than systems that would [illegible] or even treble the present [illegible] efficiency. [illegible] is meant the percentage of energy value of the [illegible] converted into electric energy. It is well known also, that the condition even arises when [illegible] load, which will improve the load factor [illegible] affecting the maximum load, would be [illegible] a rate less than cost, the profit being [illegible] increased efficiency of the whole outfit.

Central station men cannot be [illegible] plain indication for the future. The [illegible] of private plants, the increasing frequency [illegible] incandescent gas burners are [illegible]

lamps, and the readiness which many gas companies have shown in reducing their charges, all point to the conclusion that a reduction that will permit competition with gas and steam is the only condition upon which the general extension of the use of the electric current can be assured.

One result of the new method adopted has furnished in this connection a gratifying assurance of the benefits to be derived. A large mercantile house, in which lamps are burned all day, to light the basement, had substituted gas in place of the incandescent lamp. Since the introduction of the double-rate method, however, the gas lights have been removed and the electric lamps restored. Both changes were made in the interest of economy.

The duration of the hours of low rate will be fixed by the manager of the central station. The time at which this period begins will be regulated by the time at which the peak hours may be expected, and this will be, in a measure, influenced by the season of the year. For instance, in winter the high rate, or full rate period, may begin at 4 p. m., and continue until, perhaps, 11 or 12 p. m. In summer, when the evenings are shorter, the hour at which the full rate begins and ends will be varied in accordance with the time when the maximum demand upon the generating plant may be expected.

The controlling switch at the central station is placed upon the switchboard at a convenient point. At the hour fixed for the change from one rate to the other, an employe throws the switch-blade on the switchboard into the clips which form part of the circuit of the electro-magnet that is to operate the pivoted arm of the controller. The switch-blade need not remain in the clips more than one or two seconds, and in that time every pivoted arm of every controller on the system is withdrawn from the clips in which it [illegible] and thrown into the clips on the other side of the arm. This action, where two meters are used, opens the armature or shunt circuit of the meter by which one rate is registered, and closes the corresponding circuit of the other meter. Thus [illegible] to act at the moment when the latter begins.

If a single meter, only, is installed at each point of consumption, as shown in Fig. 4, the action of the controller is the same, but instead of the alternation last described, the throw of the pivoted arm of the controller simply inserts or cuts out a resistance in each meter circuit which varies the registering action to the required degree. The same result can be produced by causing the pivoted arm of each controller to shift the meter circuit from the two outside mains of a balanced system to one outside and the neutral. This varies the voltage in such manner as to produce a registering action of double the speed [illegible] with the other [illegible]

[illegible] accidentally [illegible] the [illegible], by which the controllers may be operated at the wrong time, a separate [illegible] mounted on the switchboard and connected in the same manner as the other[s] that are placed at the [illegible] points of consumption. Upon the [illegible] controller will be the first to operate and will attract the attention of the employe at the switchboard, who will, in such an event, operate the main switch and thus restore all the controllers to their proper positions. Means, however, have been provided by which this result can be accomplished automatically.

Power Development at Massena.

By Orrin E. Dunlap.

The water-power development on the St. Lawrence River at Montreal is not to stand alone as the single great development of that river, but it is to have a rival in a plant now being constructed at Massena, N. Y. Unlike the power installation near Montreal, the Massena plant has no large city close by to use the electric energy it is expected to make available, but on the contrary it is located in a section of country where possibly the important advantages to be offered in the way of power alone must act largely in developing a market for the power to be generated. It is well known that the possibility of obtaining really cheap and constant power acts as a great incentive to the building up of a locality, and the promoters of the Massena development have confidence in marketing their product, as is evidenced by the manner in which they are building.

Those who have seen and are familiar with the method of development employed by the Niagara Falls Hydraulic Power and Manufacturing company at Niagara Falls will recognize in the Massena project a slight similarity. In the Niagara plant the upper river is the head-race and the lower the tail-race, the water used for power purposes flowing from one to the other through a canal. In the Massena project the famous St. Lawrence River is to be the head-race and the Grass River, a small stream, is to be the tail-race. The distance across country from the St. Lawrence to the Grass River is about three miles, and this represents the length of the surface canal now being built. The contracts for this work and for the power house are in the hands of the Lehigh Construction company of South Bethlehem, Pa., which, it is understood, bears the same relation to the St. Lawrence Power company that the Cataract Construction company does to the Niagara Falls Power company. The line to be followed from the St. Lawrence to the Grass River is practically straight. The canal will be 225 feet wide and 25 feet deep. This will necessitate a vast amount of excavation, but the plateau between the two rivers is of material easily excavated, being of sand, clay and gravel. In order to facilitate the work Engineer John Rice of the Lehigh Construction company has designed a dirt conveyor which will no doubt be one of the most interesting features of the construction plant. This conveyor is shown in Fig. 1. In appearance it resembles a great derrick being 230 feet long, while its height is 60 feet. It is mounted on trucks which run on a temporary railway track laid on the bed of the canal. Buckets will traverse the entire length of the machine on an endless chain, and as fast as steam shovels can loosen the earth the buckets will pick it up and carry it to the other end of the [illegible] will be dumped well outside of th[e] [illegible].

FIG. 1. POWER DEVELOPMENT AT MASSENA.—VIEW OF CHANNEL LOOKING NORTH FROM POWER HOUSE, SHOWING CONVEYOR.

The map, Fig. 2, gives a good id[ea] [illegible] of the St. Lawrence and Grass rivers and the power canal to connect them. The head of the canal on the St. Lawrence is slightly below a promontory which it is expected will serve to deflect to the opposite shore all the drift and ice coming down the stream and which would be likely [illegible] the canal. At this point the St. Lawrence has in the Long Sault Rapids a fall of about 50 feet, and the Grass River, at the point where the power canal will discharge into it, is about 45 feet below the level of the St. Lawrence above the rapids. The canal will discharge the water onto the turbines at a head of about 40 feet, and after passing the turbines the water will return to the St. Lawrence by the Grass River. Thus the water used will be but a short time diverted from its original course. It will in no way interfere with navigation, as the channel from which it is taken is unnavigable. The river's navigable channel is on the Canadian side at this point. In its complete form the power house of the Massena plant, as shown in Fig. 3, will be between 500 and 600 feet long and 130 feet wide. This structure will stand on the rock bed of the Grass River, and the rock will be excavated in order to allow a free discharge of water from the wheels. The installation in this power station will differ from the installations with which the public is familiar in the other notable power houses of the country. The turbines will be of the vertical pattern mounted on a horizontal shaft. The generators will each be of 5,000 horse power capacity, and in all there will be 15 of them. It will require four turbines to operate each generator. The turbines to be used will be of the Victor type and made by the Stilwell-Bierce and Smith-Vaile company of Dayton, O. They are well adapted to obtaining great speed from a comparatively slow-moving body of water. The order for the generators has been placed with the Westinghouse Electric and Manufacturing company of Pittsburg. These generators will also be somewhat novel in construction and operation. They will be mounted on the same shafts with the turbines, but the distance between them will be about 80 feet. Each generator will weigh about 350,000 pounds, the weight of a single piece used in their construction being 125,000 pounds. Their outside diameter will be about 20 feet, and they will stand about 22 feet high over the foundation. Each generator will occupy a floor space of 22 by 18 feet. The speed at which they will run will be 180 revolutions per minute.

The contract for these generators was the largest ever made at one time for electrical apparatus, and it should be noted that their capacity is to be the same as the big generators in the station of the Niagara Falls Power company, while the number ordered is five more than will be placed in the power house extension of the same company. The generators of the St. Lawrence Power company will, however, be of different design and vary in many ways from the great Niagara generators.

The St. Lawrence Power company, it is stated, has English capital behind it. It was incorporated under the laws of New York with a capital of $2,000,000, which was later increased to $6,000,000. The officers are: President, Walter C. Lane; vice-president, S. H. Gardyne Stewart; secretary, Carlton H. Reeve; treasurer, William C. Cox.

Changes in the Patent Law.

On January 1st several amendments to the United States patent laws went into effect. One that has attracted considerable attention is the revision of the provision relating to published descriptions of inventions prior to the date of application for patent. The exact language of the law as it now stands is as follows:

"Any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country for more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

This makes it imperative upon the inventor to apply for a patent within two years from the date of the printed description, if he expects to get a patent at all.

The new law also requires that persons who have made applications for foreign patents must, if seeking a United States patent on the same invention, file their applications at Washington within seven months from the date of the application for the foreign patent, instead of at any time during the life of the foreign patent, as heretofore. To anticipate this requirement there was an unprecedented rush of applications at the Patent Office during the closing days of the year. A Washington dispatch says that on December 28th the record was broken by 375 applications.

Elevators for Government Buildings.

The supervising architect of the Treasury Department at Washington received the following bids on January 3d for furnishing 10 freight elevators, two passenger elevators, one package elevator and one [illegible] lift for the United States appraiser's warehouse at New York:

Morse, Williams & Co., Philadelphia, electric, $68,500; steam, $78,658; time, 120 working days.

Otis Bros. & Co., New York, electric, $66,460; steam, $54,000; time, April 1, 1898.

Sprague Electric company, New York, electric, $50,000 time, April 1, 1898.

Standard Elevator and Manufacturing company, Chicago, electric, $50,000; steam, $57,400; time, April 1, 1898.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Over 80 telephones have been subscribed for in Waseca, Minn. Arrangements are about completed for constructing the system.

The Wisconsin Telephone company announces a reduction in rates at Appleton, Wis.

The Home Telephone company of Oskaloosa, Iowa, has ordered a new switchboard with 400 drops. The exchange now has 353 subscribers.

A. Goetschius is an applicant for a telephone exchange at Marshfield, Wis.

The Farmers' Telegraph association of Bear Valley, near Dixon, Wis., has taken out the telegraph instruments and put in telephones. There is now a private line of 20 miles to towns where public lines connect with this system.

A project is on foot at Detroit, Minn., to extend a telephone line to White Earth, Minn., 22 miles. There is now no connection with the White Earth Indian Reservation.

The Iowa Telephone company will put in an exchange at Dyersville, Iowa.

A telephone line is about completed between Chariton, Iowa, and Columbia.

J. J. McGeehan of Ashland, Wis., has been granted contracts by the Wisconsin Valley Telephone company to build lines to Hurley and Ironwood, and to install exchanges in Chippewa Falls and Eau Claire.

The Northwestern Telephone Exchange company has about completed its work in Albert Lea, Minn., and its crew will at once work back to Minneapolis, stringing another set of wires.

The Iowa Telephone company has put in a new switchboard at Clinton, Iowa, with 300 drops. It is a multiple board and is said to be the first of the kind in the state.

The Rocky Mountain Bell Telephone company at Butte, Mont., finds an average of 5,172 calls every 24 hours, as compared with 3,853 for the same time a year ago. If business continues to increase as it has lately, Manager Miller states that two additional stories will be erected to the company's building.

The local telephone company at Willmar, Minn., will pay a gross earnings tax of $9.88. The members of the company were inclined to argue that as the law provides for companies doing business within the state, it could not apply to those doing business in a village, but decided to pay it when the amount was learned.

There is trouble brewing in the ranks of the directors of the Mutual Telephone company of Des Moines, Iowa. The faction represented by A. T. Hess is charged by the others with working in the interest of the Bell company. It is claimed that an attempt is being made to get control at the election of directors to manipulate affairs in favor of the Bell exchange. The Hess faction denies this, and says that its desire is to have the exchange run economically.

The telephone company operating a line between Le Sueur Center and Montgomery, Minn., has $200 in the treasury. It will use this to extend the line to Cleveland, Cordova, Heidelberg and St. Thomas.

The Mississippi Valley Telephone company of Keokuk, Iowa, has increased its number of subscribers in that city until it has the largest list in Keokuk.

The telephone exchange in Chippewa Falls, Wis., answered 35,000 calls in December, which is the record for the exchange. Manager Lamoreux says the exchange business is growing rapidly. The increase during the last three months has been greater than during any other entire year.

The attorney-general of Minnesota has handed down an opinion holding that telephone companies cannot be taxed on interstate business under the gross earnings tax law. The attorney-general holds that the law is defective.

Niagara Power Development.

Public interest in power matters on the Niagara border has of late been considerably stirred up by the agitation on the part of the people of Niagara Falls, Ont., for power, by the action of the New York State Reservation commissioners in taking steps to secure an international agreement for the protection of the falls, by the formation of the Canadian Niagara Power League, by the attitude of the Ontario government upon the subject of extending the time limit of the Canadian Niagara Power company, by the activity of promoters of other power projects in trying to discredit the good intentions of the Canadian Niagara Power company, and by various other causes which have had their effect on public opinion.

FIG 3 POWER DEVELOPMENT AT MASSENA.—PROPOSED POWER HOUSE FOR ST. LAWRENCE POWER COMPANY.

While it is quite true that to-day there is apparently little or no demand for electrical power at or near the Falls on the Canadian side, it is hard to foretell just what activity would be given to the industrial opportunities of the locality were all the power advantages of the spot made available for man's use, and it is therefore reasonable that the people living on the Canadian side should like to see the resources of their side of the river developed as well as their good neighbors' on the New York state side of the boundary stream which offers such exceptional power facilities.

The Canadian Niagara Power company holds an exclusive right for the development of power in Queen Victoria Park on the Canadian side. This franchise has the approval of the Ontario government and the park commissioners. Conflict has arisen over the fact that the Dominion government granted a franchise to the Canadian Power company allowing it to discharge the tail-race of its proposed development through the park lands into the river, the Ontario government, the park commission and the Canadian Niagara Power company holding this to be a violation of the latter company's rights; and the efforts of the Canadian Power company to secure recognition have been fruitless.

A. C. Denniston, who represents the Canadian Power company, has made a strenuous effort to bring about a power development in Canada in conjunction with the Canadian Niagara Power company, controlled by the Cataract Construction company, but these efforts have been entirely fruitless; and he ascribes this failure to the fact that the Cataract Construction company has no present intention of making any substantial power development in Canada. Mr. Denniston has prepared a statement in which he appeals to the Canadian prejudice against American enterprises. He says:

> The delay in the development of the Canadian power is building up the American side of the river at the expense of the Canadian. Should the American company be allowed to maintain the monopoly claimed by it of Niagara power in Canada, not only will the development of Niagara power in Canada be still further delayed, but this power when developed will be but an annex to the great American plant. The American company can certainly not afford to underbid itself in Canada. Its investment on the American side now reaches $6,000,000, and it cannot prejudice the future productiveness of this investment by setting up a rival to itself in Canada.
>
> The opposition of the Cataract Construction to the plans of the Canadian Power company has been based solely upon a forced and unwarrantable construction of the very plain terms of its agreement with the park commissioners. A monopolistic privilege can never be stretched beyond its plain intent, and there is nothing in the agreement of the park commissioners to prevent their giving to the Canadian Power company the permission asked, merely to discharge across or under the park the waters of its canal to be constructed from the Welland river.
>
> The present plan seems to be to bring about in conjunction with the Park and River railway a small and unimportant development, meeting in this way some obligations incurred of supplying power, and, having the matter entirely in its own hands, fix the cost of power to suit itself, and so manipulate matters as to give an apparent warrant for the claim that no substantial development of power is demanded in Canada. Upon this point let me say in passing that the applications for power made to us established the fact beyond any doubt whatever that a large and important development is at once demanded on the Canadian side of the river.

Following the publication of this letter a public meeting was held in Niagara Falls, Ont., under the auspices of the Canadian Niagara Power League, at which William B. Rankine, secretary of the Canadian Niagara Power company, made an address. He said that many obstacles had been found in the way of the Niagara Falls Power company, and that naturally no work could be done on the Canadian side of the river until the problems had been solved. He added that it was the intention of the Niagara Falls Power company, when the Canadian plant was constructed, to work both the Canadian and American plants in conjunction, thus securing to all customers a constant power supply. If a break-down is experienced on the American side the customers will be switched onto the Canadian plant, and if trouble is met with on that side the Canadian customers will be thrown on the American plant.

One of the most interesting statements made by Mr. Rankine was that three months before the expiration of the time limit on the Canadian agreement, it was discovered that the walls of the wheel pit on the American side were gradually coming together. About half-way down the pit the rock was beginning to creep, as geologists term the action, and a new and exceedingly dangerous situation confronted the company. All plans were upset and nothing was thought of save a remedy for this impending disaster which threatened to put an end to the future operations of the company. The experience of eminent engineers was called into service to ascertain the cause of the creeping of the rock. All was done that could be to stay the work of destruction, when the creeping ceased, on August 15th, almost as suddenly as it began, but the delay and anxiety had caused the company to allow the time limit on the Canadian side to lapse, and another extension of time was asked for. He announced that all difficulties have now been practically surmounted, and the company will soon be in position to make a proposition that will satisfy the claimings for power on the Canadian side. Propositions are being received for long-distance transmission to Toronto, and this matter must be settled before power will be developed, for all admit that there is not sufficient demand in the vicinity of Niagara Falls, Ont., to warrant the erection of an expensive plant.

At the close of the meeting the following resolution was adopted: "It is the opinion of this meeting that it is in the public interest that there should be more than one power development at Niagara Falls, Ont."

Frank P. Crocker has made application to the council of Hammond, Wis., for a franchise for electric lighting.

FIG 2 POWER DEVELOPMENT AT MASSENA.—MAP SHOWING ROUTE OF CANAL.

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And further this affiant sayeth not.

FRANK FOSTER KENWORTHY.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES, Notary Public.

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Every central-station manager is interested in the methods in vogue of charging for current, and any innovations that may be proposed will receive careful attention. At the last meeting of the National Electric Light association this subject formed the principal topic of discussion, and later at the Edison convention similar problems were considered. Mr. Eustace Oxley has prepared an article on this subject which is presented on another page this week. The method of controlling the meter upon a distributing system, as described in the article, has been adopted by the United States Electric Lighting company of Washington, which installed it at a number of points upon the company's lines on July 6th. The success of the method has been very gratifying, and the beneficial results are believed to justify the publication of the description of the method and apparatus employed.

Much interest is manifested among electrical men in the West, particularly in Chicago, in the forthcoming convention of the National Electric Light association. It is pretty generally understood that there will not be a general exhibition of electrical machinery and supplies in connection with the convention, but it is probable that there will be many individual exhibits at the headquarters of the several companies. On President Insull's return from Europe it is understood that he will appoint the committees to which will be assigned the work of preparation for the meeting and the entertainment of visitors during the convention. He has already formulated a general plan for the meeting, but the details had not been sufficiently worked out before his departure to permit of publication. The sentiment of the members seems to be in favor of making the Chicago meeting the largest gathering of central-station men that has ever been assembled in the country.

The policy of the administration of Greater New York toward the rapid transit plans is indicated by the first message of Mayor Van Wyck, and certainly cannot be construed as favorable to the underground project. The people of Greater New York need not look to Tammany for assistance in securing rapid transit at the expense of existing interests. Mayor Van Wyck expresses fears lest the credit of the city might be affected by the obligations it would incur in building the underground road. He urges improvement in the "L" service, however, and recommends the adoption of electricity upon these lines. He says: "To my mind there can now be urged no sufficient reason for the continued employment of the locomotives now in use on the elevated roads, and the people should no longer be subjected to the resulting nuisances of noise, smoke, and flying cinders. You should demand and insist upon the substitution, in the place of the present motive power, of electricity, which can now be safely utilized in the operation of these roads, affording a more cleanly and less noisy service, and that, too, with an improvement in speed." He urges, also, extensions and improvements on the present lines and the running of express trains day and night. The surface roads, it is also pointed out, should be compelled to improve their service.

Heretofore inventors have been permitted to make application for patent protection whenever convenient without regard to the issuance of foreign patents, but under the law which went into effect January 1st an important change takes place. The new law inhibits the patenting of any invention which has been patented or described in any printed publication in this or any other country more than two years prior to the application. No patent shall be refused nor shall any patent be declared invalid by reason of its having been patented first in a foreign country unless the application was filed more than seven months prior to the application in this country. Under penalty of being regarded as abandoned, the application must be completed and prepared for examination within a year after filing. An interference will not be declared between an original application and a patent issued more than two years prior to the date of filing the application. It should be borne in mind also that the term of the United States patent will not be shortened by the prior filing or issue of a foreign patent for the same invention. It is possible, therefore, for the American inventor now to proceed with foreign applications without waiting for his United States patent to be issued. The new law is practically the same as that existing in England.

A Washington correspondent says that just before the new law went into effect, at the beginning of the new year, the rush of belated applications was so great as almost to cause a congestion in the work of the Patent Office. That department will be badly crippled for a time unless additional help is provided.

Charles G. Armstrong, in a recent article, notes the interesting fact that the inclosed arc lamp was seemingly anticipated in Jules Verne's "Twenty Thousand Leagues Under the Sea"—a book which also foreshadowed the submarine boat and other modern actualities. As quoted by Mr. Armstrong, the French writer mentioned that "that wonderful ship was lighted by an arc lamp. The electric lamp was combined in such a way as to give its most powerful light—indeed, it was produced in vacuo, which insures both its steadiness and intensity. This vacuum economized the graphite [carbon] points, between which the luminous arc was developed—an important point of economy," etc. * * * "Under these conditions the waste [the carbon] was imperceptible." Mr. Armstrong comments as follows: "Had he said their waste was very gradual he would have exactly portrayed the present operating condition of the inclosed arc lamp. While there is no evidence that he knew anything about electricity, he certainly made a fair guess as to what would be a good commercial article in 1897. If he were to ape the methods of some of our prominent electrical inventors he would undoubtedly come forward at this time and claim priority of invention."

It is fair to remark that Mr. Armstrong seems to underrate M. Verne's scientific attainments, as all the contemporaries and intimates of that entertaining story-teller agree that he kept fully abreast of the scientific thought of the day, which his capacity and tastes permitted him to thoroughly assimilate. His art consisted in the adroit manner in which he used his scientific knowledge to give verisimiltude to his daring flights of imagination. Yet the fact that in several cases his fancied creations have been to some extent realized in fact seems to show that he is entitled to a greater recognition than that of a happy guesser.

On another page is printed the text of the ordinance now pending in the Chicago City Council which has for its object the creation of a Department of Electricity in the city government. It will be read with interest, especially by the electrical men of Chicago, who are primarily affected. The greater part of it relates to electrical inspection, and the duties of the department are briefly set forth. As will be seen, while the electrical interests of the city government are directly placed in the charge of the proposed department, supervision will also be had over all electrical installations, public and private, in Chicago.

If the ordinance secures the votes of the necessary number of the aldermen, there is little doubt that the mayor will sign it, and it is further expected that he will appoint as the first head of the new department Edward B. Ellicott, the present superintendent of city telegraphs and the city electrician de facto if not de jure. If the ordinance fails to become a law, then it would seem that under the civil-service law, as recently interpreted by the Supreme Court, the position of Mr. Ellicott, as the head of a bureau, is one that must be filled from a list of eligible candidates furnished by the civil-service commissioners, after competitive examination.

Whatever disposition is made of the matter, the Western Electrician desires to express its conviction that Mr. Ellicott, in discharging the duties of city electrician for the last six months, has given the city good service. He has worked hard, and we believe he has conducted the office without favoritism. His record is almost too short to judge, but it seems altogether promising, and we are persuaded that he is entitled to the commendation of the people, whom he serves. It will be a pity if the position of this useful public servant is jeoparded by a law intended for the improvement of the public service.

A Department of Electricity Proposed for Chicago.

An ordinance creating a municipal Department of Electricity is pending in the Chicago City Council. It has been referred to the committee on judiciary, of which Alderman Walker is chairman. The full text of the ordinance is as follows:

An Ordinance Providing for a Department of Electricity.

Be it ordained by the City Council of the city of Chicago:

Section 1. That paragraphs 589 to 598 inclusive of Chapter XXV. and paragraphs 623 to 628 inclusive of Chapter XXVI. of the "Revised Code of Chicago, 1897," be and the same are hereby repealed.

Sec. 2. That in lieu thereof the following ordinance is hereby enacted and numbered by paragraphs as follows, and designated as a part of Chapter XXV. of the "Revised Code of Chicago, 1897," viz.:

Chapter XXV.—Department of Electricity.

589. Department Created.—There is hereby established an executive department of the municipal government of the city of Chicago, which shall be known as the Department of Electricity, which shall include a city electrician, an assistant city electrician, a superintendent of construction, a chief clerk, two bookkeepers, two stenographers, one chief inspector and nine assistant inspectors, and such other assistants and employes as the City Council may by ordinance establish.

590. City Electrician.—There is hereby created the office of city electrician, who shall be the head of said department of electricity, who shall be a practical and skilled electrician, and who shall not be engaged in any other business while acting in said capacity. He shall hold his office for the term of two years and until his successor shall be appointed and qualified. He shall be appointed by the mayor, by and with the advice and consent of the City Council, whenever a vacancy exists in said office by removal or otherwise.

591. Bond—Approval of.—Said city electrician, before entering upon the duties of his office, shall execute a bond to the city of Chicago in the sum of $20,000, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

592. Powers—Subordinate Officers—Bonds—Salary.—He shall have the management and control of the fire-alarm telegraph and police telephone system, of all municipal electric lighting, of the inspection of all electric wiring within the city limits, both inside of buildings and above, beneath and upon the surface of the streets, and of all electrical matters in which the city is interested, and shall appoint, by and with the consent of the mayor, and in accordance with law, all subordinate officers and assistants named herein and that may hereafter be provided for, and may remove them for inefficiency or neglect of duty in accordance with law. All subordinate officers, assistants, clerks and employes in said department shall be subject to such rules and regulations as shall be prescribed from time to time by said city electrician. Said city electrician shall require good and sufficient bonds to be given by all subordinate officers and employes in said department who shall receive, or have the care, custody or handling of any money belonging to the city of Chicago, and said bonds shall be approved by the mayor and comptroller. The salary of the said city electrician shall be the sum of $4,000 per annum.

593. Assistant City Electrician—Qualifications—Duty—Salary.—There shall be appointed an assistant city electrician, who shall be a practical and skilled electrician, and who shall act as city electrician in case of the absence of the city electrician from his office, and, while so acting, shall discharge all the duties and possess all the powers invested in and imposed upon the city electrician. The salary of the assistant city electrician shall be the sum of $3,250 per annum.

594. Superintendent of Construction—Powers—Duty.—There shall be appointed a superintendent of construction, whose duty it shall be to put in new circuits and install all new work of the city under the direction of the city electrician. His salary shall be the sum of $1,800 per annum.

595. Other Officers—Powers—Duties—Salaries.—There shall be appointed the several officers and employes of the department named in paragraph 589 hereof, whose appointment is not hereinbefore provided for, and the powers, duties and salaries of such officers and employes shall be such as may be required and prescribed by the city electrician, the rules and regulations of this department and the ordinances of the city.

596. Electric Current.—No electric current shall be used for illumination, decoration, power or heating, except as hereinafter provided.

597. Application—Contents—Permits.—All persons, firms or corporations desiring to make use of electric currents for any of the purposes mentioned in the preceding paragraph of this chapter, shall, before commencing or doing any electrical construction work of any kind whatever, either installing new electrical apparatus or repairing apparatus already in use, file an application for a permit therefor in the office of the city electrician, which application shall describe in detail such material and apparatus as it is desired to use, with a full description of the same, giving the locality by street and number; and upon receipt of which application, if found proper, such permit shall be given.

598. Duties of City Electrician Thereon.—The said city electrician shall then have power, and it shall be his duty, when by him deemed necessary, to carefully inspect any such installation previous to and after its completion, and it shall be competent for him to remove any existing obstructions which may prevent a perfect inspection of the current-carrying conductors, such as laths, plastering, boarding or partitions; and if such installation shall prove to have been constructed in accordance with the rules and requirements of the Fire Department of the city of Chicago, controlling the use of electric current upon the payment of a fee, as herein provided, he shall issue a certificate of such inspection, which shall contain a general description of the installation and the date of said inspection. The use of electric current is hereby declared to be unlawful previous to the issuance of said certificate; provided, however, the city electrician may issue a temporary permit for the use of electrical current during the course of construction or altering of buildings, which permit shall expire when the electrical apparatus for such building is fully installed.

598a. Preliminary and Final Certificate.—A preliminary certificate may be issued by said city electrician in the case of completed installation, but upon which no current will be used in the immediate future. Such preliminary certificate shall show that at the date of inspection the installation was erected in accordance with the terms of this chapter, and shall be issued at one-half the rates hereinafter named. Prior to the introduction of electric current into the said premises a second inspection shall be made, when, if the said installation is still in accordance with the terms of this chapter, a complete and final certificate shall issue, and the amount of the fee paid for the preliminary certificate shall be deducted from the fee for the final certificate. Any owner or owners of property installing electric wires to be hidden from view shall, prior to such installation, give said city electrician a reasonable notice in order to give ample time for inspection.

598b. Power of City Electrician—Penalty.—The said city electrician is hereby empowered to inspect or reinspect all overhead, underground and interior wires and apparatus conducting electric current for light, heat or power, and when said conductors or apparatus are found to be unsafe to life or property, shall notify the persons, firms or corporations owning, using or operating them to place the same in a safe and secure condition within 48 hours. Any person, firm or corporation failing or refusing to repair, change or remove the same within 48 hours after the receipt of such notice, shall be subject to a penalty of $10 for each and every day such conductors and apparatus continue to be in an unsafe condition.

598c. Poles — Covers — Wires — Branded and Tagged.—All poles now standing or hereafter erected, and all covers for manholes now in service or hereafter placed in service for the use of electric conductors, shall be branded or stamped with the name of the person, firm or corporation owning the same; and all electric service entrances shall have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner of, and giving such a full description of the conductors as shall meet with the approval of said city electrician.

598d. Fees.—There shall be collected by the said city electrician and paid into the treasury of the city of Chicago, upon the issuance of certificates permitting the use of electric currents, the following fees:

For each arc light, the sum of............	$1.00
For each incandescent lamp of nominal 16 candle power, and for larger or smaller lamps in that proportion..............	.10
For each electrical horse power of 746 watts, used for mechanical or other purposes than above mentioned.	1.00
But no inspection shall be made for a less amount than..................	1.00
Inspection of temporary installation for show windows, exhibitions, conventions and the like shall be charged for by the time required for such inspection, at the rate of, per hour.....................	.50

For each re-inspection of any overhead, underground and interior wires or apparatus, there shall be collected by said city electrician at the rate of one-half of the fees prescribed in this paragraph.

598e. Record—Annual Report. It shall be the duty of the said city electrician to keep records containing a full and accurate account of all inspections made, and of all moneys received, and render a full report and account to the comptroller of the city of Chicago, on the 31st day of December in each year.

598f. Alterations.—No alterations shall be made in any installation without first notifying the said city electrician and submitting the same for similar inspection as above provided.

598g. Penalty.—Any person or persons who shall use any electric current in violation of any of the provisions of this chapter, shall be subject to a penalty of not less than $50, nor more than $100, and to a further penalty of $10 for each day during which he or they shall continue such violation. Said city electrician may, for any violation of this chapter, order and compel the cutting off and stopping such current until the provisions of this chapter are fully complied with.

Sec. 3. This ordinance shall take effect and be in force from and after its passage, and all ordinances or parts of ordinances in conflict herewith are hereby repealed.

Electrical Development in South Africa.

An increasing use is being made of electrical machinery in South Africa, as shown by the following array of news items, and the United States appears to be getting a share of the business.

The Harbor Board of Table Bay, Cape Colony, is considering the purchase of two electric cranes for the service of the port at Cape Town.

The borough engineer at Durban has recommended additions to the electric plant recently installed in that city, and it is probable that further orders for electric lighting will be called for by the Durban Town Council.

The General Electric company of New York has supplied the electrical equipment for the De Beers mine. It includes three tandem-compound engines of 175 horse power each, two 50 kilowatt six-pole compound dynamos of 220 volts and 115 volts respectively, a large switchboard furnished with voltmeters and ammeters, and 12,000 feet of large copper cable. The General Electric company also furnished two 165 horse power generators and a fine switchboard for the Witwatersrand (Knight's) mine.

The electrical pumping plant furnished to the Knight Central mine is also from America. It includes a 550-volt generator. The Goulds Manufacturing company supplied the equipment. The pumps are 4½ by 8 inches dimensions; they are of American pattern, each of a capaciy of 35,000 gallons per hour, and are arranged in pairs to minimize delay in case of accident.

The pumping plant ordered for the Witwatersrand deep mine is also from the Goulds company. It consists of four Gould triplex pumps, installed in pairs at each station, the former 6½ by 8 inches, and the latter 4½ by 8 inches, and of 4,800 and 3,600 gallons capacity, respectively.

Several good orders have been sent to England in connection with the installations of electric lighting plants, which are progressing as rapidly as possible under the circumstances. Orders for telegraphic and telephonic materials, too, have been sent to England within the last two months.

Street Railway Litigation.

According to the Economist, the Chicago General Railway company entered the first condemnation case under the Allen bill, for the purpose of connecting the line on Throop and Morgan streets. It also carried to the Supreme Court of this state as plaintiff in error against the city of Chicago its action respecting the unconstitutionality of the custom of the city of collecting annual revenues by alleged contract, a case which attained widespread attention, as it applied to street railways in all large cities in the country. Steps have been taken preparatory to placing the road under the operation of the interstate commerce law. A very full statement was prepared with reference to the legal status of the new issue of bonds made during the year, comprising the several acts taken by the company prior to their issue, the property which they cover, and such other information as would be of value to an investor. These bonds bear five per cent. interest, are in denominations of $500 and $1,000 each, and are due in 1935. It is explained that these bonds were issued on account of the important extensions made, including lines to the Drainage Canal, Union Stock Yards, running through a populous section of Lawndale, and an extension of the main line to Wabash avenue. The business of the road was more than doubled by these extensions.

Electrical Legislation in Virginia.

Among the bills of an electrical nature that have been introduced in the present Virginia Legislature are the following:

By A. Maupin of Richmond: To require telephone companies to pay a tax of one per cent. per annum on their gross receipts, instead of $1.50 on each transmitter, as at present.

By T. D. Jennings of Lynchburg: Providing for the incorporation of the Virginia Electrical Railway and Development company.

By Mr. Saunders of Franklin: To define and declare what shall constitute a telegraph, telephone or express company, and to provide a method for the determination of the value of its property within the state for the purposes of taxation.

By Mr. Cooke of Norfolk: To incorporate the Norfolk Bicycle Road company.

Fear Acetylene Gas.

The Jersey City fire commissioners have ordered a special investigation to determine whether the use of acetylene gas shall be permitted in dwelling houses, factories and business places in the city. In his search for places where the gas [illegible] the fire marshal discovered two kinds of acetylene. One is the liquefied gas which was [illegible] the United States Liquefied Acetylene [illegible]

company, whose works were blown up; the other is brought from Niagara Falls in hermetically sealed cans, and used for illuminating purposes in gas machines. Until the fire board acts the use of gas machines will not be permitted.

Ocean Cables in War Times.[1]

By Alexander Porter Morse

Eleven submarine cables traverse the Atlantic between 60 and 40 degrees north latitude. Eleven of these connect the Canadian provinces and the United States with the territory of Great Britain; two (one American, the other Anglo-American) connect France. Of these seven are largely owned, operated or controlled by American capital, while all the others are under English control and management. There is but one direct submarine cable connecting the territory of the United States with the continent of Europe, and that is the cable owned and operated by the Compagnie Français Cables Telegraphiques, whose termini are Brest, France, and Cape Cod, on the coast of Massachusetts. All these cables between 60 and 40 degrees north latitude, which unite the United States with Europe, except the French cable, are under American or English control, and have their termini in the territory of Great Britain or the United States. In the event of war between these countries, unless restrained by conventional act, all these cables might be cut or subjected to exclusive censorship on the part of each of the belligerent states. Across the South Atlantic there are three cables, one American and two English, whose termini are Pernambuco, Brazil, and St. Louis, Africa, and near Lisbon, Portugal, with connecting English lines to England, one directly traversing the high seas between Lisbon and English territory, and one touching at Vigo, Spain, at which point a German cable company has recently made a connection. The multiplication under English control of submarine cables has been the consistent policy of Great Britain, and to-day her cable communications connect the home government with all her colonies and with every strategic point, thus giving her exceptional advantages for commercial as well as for political purposes. The schedule blanks of rates of the English companies contain the following provisions: "The dispatches of the Imperial government shall have priority when demanded. The cable must not, at any station, employ foreigners, and the lines must not pass through any office or be subject to the control of any foreign government. In the event of war, the government [of Great Britain] may occupy all the stations on English territory or under the protection of Great Britain, and it may use the cable by means of its own employes."

It is not a pleasing reflection that in the actual situation the United States is at a great and embarrassing disadvantage. Meanwhile it would seem to be the policy of the United States to overcome this disadvantage by the multiplication of submarine cables under American or other than English competing foreign ownership and control.

Although somewhat indeterminate, the policy of the United States in respect to the landing of foreign submarine cables, so far, at least, as the executive branch of the government is concerned, appears to be based chiefly upon considerations that shall guard against consolidation or amalgamation with with other cable lines, while insisting upon reciprocal accommodations for American corporations and companies in foreign territory. The authority of the executive branch of the government to grant permission is exercised only in the absence of legislation by Congress regulating the subject, and concessions of the privileges heretofore have been subject to such further action by Congress in the matter as it may at any time take. Several bills are now pending in Congress relating to the landing of foreign submarine telegraph cables within the United States, and regulating the establishment of submarine telegraphic cable lines or systems in the United States. As this article is going to press, it is reported that the president has refused permission to a foreign cable company to renew a cable terminus within the territory of the United States, and that the question raised as to the power of the federal government to deny admission to the cable will be referred to the attorney-general for an opinion. Meanwhile, the executive branch of the government holds to the doctrine that, in the absence of legislation by Congress, control of the landing and operation of foreign cables rests with the president. The question of the landing of foreign cables [illegible] consideration from the late [illegible] in connection with an injunction suit brought by the United States against certain corporations engaged in placing on the coast of New York a cable having foreign connection. And he suggested for the consideration of Congress whether it would not be wise to give authority to some executive officer to grant or withhold consent to the [illegible] of such foreign enterprises [illegible] such terms and conditions as may [illegible].

The principal and most important submarine cables traversing or [illegible] are owned and operated by private [illegible] companies. They are in number [illegible] and their length in nautical miles is 130,7[illegible]. The length of cables owned or operated by state governments is, in nautical miles, 18,132.

The policies of states, the movement of fleets and armies, and the regulation of the markets of the commercial world, depend upon devices, communications and orders that are habitually transmitted through the agency of submarine cables. In this view, the first aim is to safeguard from wanton destruction the delicate and expensive mechanism of these cables; the second is to restrain within the narrowest limits practicable interruptions in the operation of cables, even in the midst of hostilities; and the third is to encourage the establishment and extension of submarine cables owned and operated by American capital. All these ends may be advanced by the agreement of the powers to neutralize absolutely the submarine cable systems of the world.

1. From the Albany Law Journal.

Ownership of Submarine Cables.

[From the New York Sun.]

There are, in all the world, 1,000 submarine cables owned by governments besides those owned by individuals and corporations, and they have a length of 20,000 miles. Every important country in the world, and nearly every minor country as well, has some such national cable—except the United States. Norway owns 264 cables; England, 246, including the Indian cables; France, 54, with a length of 5,000 miles; Germany, 54; Austria, 35; Greece, 47; Denmark, 60; Spain, 15; Turkey, 23; Japan, 34; Russia, 9; Sweden, 14; Italy, 39; Holand, 20, and Belgium 2. The explanation of this national ownership in cables, to which the United States is the only conspicuous exception, is found in the fact that in most foreign countries control of the telegraph service is under control of the government, and that the cables may be needed for war purposes.

In addition to the cables owned by governments, there are about 300 owned by corporations, with an aggregate length of 150,000 miles. The longest of these is the cable between China and Australia. The cable between Egypt and British India is another of the very long ones, and still another is the Brazilian cable between Lisbon and Pernambuco. Not one of the North Atlantic cables can compete with these in length. The French cable from Brest to Cape Cod, with a branch to St. Pierre, is 3,000 miles long. The Commercial cable from Waterville, Ireland, to Nova Scotia, is nearly 3,000 miles and the Anglo-American cable from Penzance to Nova Scotia is about 2,600 miles long. Cables owned by corporations pay better as a rule than those under direct or quasi-government control. The Atlantic telegraph cable was successfully laid in 1866, and the length of the original cable was 1,866 miles. The Great Eastern, which laid it, made no higher run than 128 miles a day and no lower run than 105. Fifteen days were spent in the work.

"Reasonable Compensation."

[From the Chicago Inter Ocean.]

Of all the corporations in the enjoyment of special privileges of valuable franchises in this city, the street railway companies are best able to exhibit direct proofs of the benefits they have bestowed upon the public in return for favors received.

While the steam railway companies, the gas companies, the electric lighting companies, the telegraph companies and the telephone companies have all contributed to the upbuilding of Chicago, the business they have enjoyed has been developed for them, to a great extent, by the street railway companies, which have not been content to serve the populous and profitable districts of the city alone, but have gone forward in their work of opening up new territory and peopling it, though profits from such extensions may not be counted upon for many years to come. The steam railway companies, the gas companies, the electric lighting companies, the telegraph companies, the telephone companies, the express, and all other companies, as well as the real estate owners and agents, the shopkeepers and tradesmen of this city, are benefitted by every mile of new car tracks laid through new territory by the street railway companies. The public treasury should gain in revenue annually in proportion to the benefits derived by corporations and property owners, if taxes were equitably levied and collected.

Demand for "Canned Electricity."

A Chicago concern received an interesting letter from a country customer recently upon the subject of "canned electricity," which the Western Electrician is permitted to reproduce, omitting, for obvious reasons, everything that might lead to the identity of the persons between whom the communication passed. Following is the text of the document.

[illegible]

Niagara Power in Buffalo.[1]

By Horatio A. Foster.

I will try to present to you in a concise form what has been done up to date to place the power in condition for your use.

To say nothing about the long line of overhead conductors between the power house at Niagara Falls and the cable terminal house at Black Rock, together with underground conduit and cable leading up to the transformer house in the rear of the Buffalo street railway power house, there have been laid a large amount, something over 100 miles, of conduit on Main, Niagara and Ohio streets. A transformer house has been built on Ohio street for the distribution of current in the region which includes the island and all its elevators and other enterprises and the large manufacturing district in the immediate neighborhood. Another distribution point will be at 40 Court street, the present station of the Buffalo General Electric company, and other distributing stations will be provided as fast as the demand in different regions calls for power sufficient to warrant their installation.

Inquiry is often made as to how the power will be distributed about the city, as to whether the distribution will be made by alternating currents of high pressure or low pressure or by continuous currents and methods similar to those in use in other communities. Although it may seem to those not directly connected with the engineering part of the project that such a decision might be arrived at without much trouble, it is a fact that until it is known what amounts and in what units the power will be demanded it is not possible to make a positive decision as to just which method or whether any one method will be chosen.

As far as the engineers have been able to decide it is more than likely that the alternating current at a moderate pressure will be used for large powers and a continuous current of about 500 or 550 volts will be used for the distribution of power in units of, say, 75 horse power and less. Perhaps to the layman it might seem best to decide on one method and stick to it, but when one becomes acquainted with the great elasticity of alternating currents and the use of the motors developed for connection to such circuits the more value there would seem to be in combining the two methods.

As an example of the alternating current I would instance the application of the induction motors now used at the Great Northern elevator and the Electric grain elevator, both of which places, as you know, might be made dangerous if there were any source of or possibility of sparks or flame from any part of the machinery, and the motors installed in both of these places are of such construction that it is absolutely impossible for a flame or a spark to be developed from the machine unless so much neglected as to be of no use. It is unnecessary for me to make any comparison of these motors with those in use on continuous-current circuits, as you are doubtless, most of you, familiar with them, and they are somewhat cheaper and easier of application to ordinary work.

In order to demonstrate some of the benefits that are likely to arise from a use of electric power at low cost, I will call your attention briefly to some of the methods now most commonly pursued in applying mechanical power. In the city of Buffalo the source of power is, of course, the steam engine, or in some isolated cases the gas engine, the application of power from either being the same. First, we have the main belt from the flywheel of the engine to a jack-shaft or main shaft, this shaft extending for a distance sufficient to allow belting to line shafts in various directions, but always parallel to or at right angles to the original main line. From these line shafts various small counter-shafts are run by belting, and at last the power is applied directly to the machinery by belting from the smaller or counter-shafts. Now, you well know that the line of shaft, together with the main belt from the engine, all the bearings on the shaft, all the belts to line shafting, the bearings of the same, all the belting to counter-shafting and the bearings on the same, require power, and this power is running to waste all the time, whether the machinery is in use or not.

Many investigations of the amount and percentage of this waste power have been made during the last 10 years, and all authorities seem to agree that 30 to 80 per cent. of all power so developed goes to waste in friction losses in running belting and shafting, so that when we get to the machinery itself but from 70 down to as low as 20 per cent. of the original power is available for use. It is therefore easy to understand that if but a fraction of this power can be saved for use a very considerable gain may be made; and this fact always should be given serious consideration when discussing the application of electricity to manufacturing purposes. It is fair to estimate that the average loss between the engine and machines using power will exceed 50 per cent. of the power developed, and this would seem to furnish a good margin, even at the same price, to warrant a manufacturer in adopting electric power.

In the matter of convenience of application, handiness in use, enabling more work to be gotten out of machinery with the same amount of applied

1. Read before the Real Estate Exchange, Buffalo, N. Y., December 29, 1897.

power, I only need to say that in cities where there has been a more general adoption of electric power, as in Boston, New York and Chicago, it is the exception to find any other form of power given any consideration. As a modern instance I will call attention to the American Lithographing company in New York city, which has equipped every machine on all the floors of its great building with electric motors in a way which makes perhaps the best sample of the kind in present use.

Another point which I am sure will be of special interest to all Buffalonians is the matter of cleanliness. I am sure that every Buffalonian will welcome the day when he can stand on the top of some high building downtown and in no direction find black smoke pouring in volumes from chimneys of manufactories and other buildings; and if the smoke outside is practically removed and motors are applied to the machinery inside the buildings without the intervention of so many pulleys and so much belting, we shall be able to see clean ceilings and walls and windows, cleaner machinery and probably cleaner help and a far superior grade of work produced.

You doubtless will understand that no project of the magnitude which this promises would be gone into by any association of capitalists without a most thorough investigation into the probable results; and in this line it was necessary for them to know the conditions as to use and cost of power as now existing in Buffalo and such other communities as might come within the range of its operation. For this purpose extensive researches were made into authorities and papers that had previously been made up on the subject of cost of mechanical power and its application, and on its own account the company instigated examinations and investigations into the actual cost of power, its method of application and the probable saving by the substitution of cheap electric power in Buffalo and other places. The results of these original investigations, while differing from those of others in that a greater variety of applications and a greater variety in amounts of power used came under the notice of the investigator, have proved two or three things that, while probably known to engineers and others in interest, have been brought more forcibly to their notice: First, that few users of power know anything about its unit cost, and few even have taken the care to determine the total cost of power as used in their own business, to say nothing about the average or even maximum amount in actual use. A second fact determined from these investigations was that no estimate of the cost of power for any industry is of any use whatever in estimating the cost of power for any other industry, and not only this, but in plants of precisely the same nature and business the variation in cost of power will often reach as high as 50 per cent., and it is therefore hardly fair in talking cost of power for any one plant to quote that of any other plant whatever. Quotations of the cost of steam power per horse power per annum are often made by a person in one community to one in another, without regarding the fact that coal is liable to vary in price $2 or $3 a ton as between the two places.

To be more specific, the cost of power in Buffalo has been found to vary from less than $20 a horse power for 10 hours a day in a factory producing its own fuel and needing but little labor on the plant to over $160 per annum per horse power for nine hours a day in another plant using a small amount of power. In one industry in which four plants were tested the lowest cost was in the neighborhood of $100 and the highest about $160; in another industry in which three plants were tested, the lowest was about $60, the highest over $200. In another industry, in which two plants were tested, and in which power is used in large amounts, very steadily, and for 24 hours a day, the variation in cost exceeded 50 per cent. The above results seem to indicate that the cost of power has not been such a small item nor so simple to estimate as may have previously been supposed, and I am strongly of the opinion that it will well pay nearly every user of mechanical power to make a thorough investigation into the cost of that which he is using, and after having done so to investigate the application and cost of Niagara power to his own purpose, and I shall then be very much surprised if he does not find it good policy to give the new power a trial, even though at some considerable expense in new installation.

In making up the schedule of rates the Cataract Power and Conduit company has had the benefit of such investigations as have been made into the unit and total cost of power in such plants as have been examined, and has applied its rates and method of charge to such plants in order to determine if the results would be any inducement to the users of power in such plants to adopt the electric current. I may say that in every case but one not only were the results financially in favor of the Niagara power, but so far in its favor that it would be difficult to understand why any man should hesitate to take it up when he learns for what price it can be had for use in his own business. There may be a few special cases like the single exception above noted in which the application of Niagara power would be of little advantage, but they would be few and far between and would cut no figure in the general results.

Although for obvious reasons it will be impossible for me to give specific prices, I may say that the cost of power as developed by the schedule of rates, as far as it has been applied, varies from 60 to 90 per cent. of the cost of steam power as actually used. And right here I wish to call attention to a point mentioned in the early part of this talk, and that is that not only is the actual cost smaller for the power as rated by the manufacturer, but by reason of the fact that in many cases the application of electric motors will save nearly or quite one-half of the amount of power now used, which saving must be added to that already made in the lower price, and the two together should be argument enough to induce the extra investment in electrical machinery to make the application to almost any manufacturer's uses.

Advancement in Transformers.

The economic results obtained from the supersession of old-type transformers by those of recent manufacture, and the substitution of one large transformer for several smaller ones, have been demonstrated in a compilation of reports received from electric lighting companies which have made the change. In almost every case the change has resulted not alone in a far more perfect operation of the system, but in an actual saving in money.

Improvement in transformer construction and the use of larger units follow similar developments in other machinery of many of the large central stations. The replacement of a large number of transformers of small capacity, manufactured when the art of transformer construction was not as far advanced as it is to-day, by a few improved transformers of large capacity, has already produced results startling in their importance.

The first instance is that of a company operating in a town of 56,000 population in Massachusetts. In this case 57 small transformers built in previous years were supplanted by 18 of a late type. The total light capacity of the superseded apparatus was 1,499 lights, of the newly installed transformers 1,624. The total core loss of the old transformers was 5,866 watts, of the new only 1,348. So much for the electrical facts. The saving is calculated as follows: 39,578 kilowatt-hours are saved yearly by the change. The value of the saved energy may be estimated at $527.70—equivalent to a saving per light capacity per year of 36.2 cents. Neglecting all the advantages of the change, except those accruing from the decreased core loss, the expense will be met in one year and nine months. The light capacity of the plant is increased nine per cent., the core loss decreased 77.5 per cent. Furthermore, on account of the decreased core loss, not less than 4,518 watts are available for sale at the regular rate with the present station apparatus. This enables the company to add 90 lamps to its circuits, producing an additional income of about $675.

The second instance is in another Massachusetts town. Here 40 new-type transformers supplanted 53 old ones. The total light capacity of those returned was 1,135 lights, of the new 1,070. The core loss in the old-type transformers was 4,845 watts, of the new type 1,343 watts. In this case the annual saving is 30,678 kilowatt-hours, or about $400, and correspond to a saving per light per year of 35.2 cents. The expense of the change, counting core loss alone, will be covered in two years and nine months. Three thousand five hundred and two additional watts are available for sale, increasing the income by $525 per year, while by the use of lamps of a higher economy some 535 kilowatt-hours additional are also available for sale.

There are still three more striking cases, in Massachusetts, of benefits derived from a similar change. In the first the regulation of the station had been so poor that the lamp bills had increased to such an extent that the question demanded immediate attention. While the saving was comparatively small, the beneficial results brought about by the change have proved highly satisfactory. In the second, 81 small transformers of old type were replaced by three of a new type. The core loss of the returned transformers amounted to 2,568 watts, of the new ones 280 watts. Th resultant saving per annum is 20,043 kilowatt-hours, or $267, the saving per light capacity per year 25.74 cents. This is an all-day station, and it is calculated that only 8½ months will be required to wipe out the investment. The third case involves the supersession of 193 old-type transformers by 37 new ones, the total light capacity of the former being 6,035 lights, and of the latter 8,210 lights. The total annual saving is 51,203 kilowatt-hours, or $683, and the total saving per light capacity 14.68 cents. In five years and two months the cost of the change will be fully covered. The capacity of the plant has been increased 36 per cent., the energy required to operate it decreased 47.1 per cent. Five thousand eight hundred and forty-five additional watts were made available and thus an additional capacity of about 116 lights was obtained without adding to the station apparatus. If these lights were burned but three hours daily the result would be an additional annual income of $960. On account of the improved regulation entailed by the change, high-efficiency lamps can be used and about 410 more watts saved. This adds $109.46 to the total annual saving.

Several interesting changes have also been made in the West. One instance in particular merits attention. The details of the change are not available, but by centralizing the transformer distribution the rate of switchboard income was changed from four cents to 12 cents per kilowatt. Another western plant reports that its 1,140-volt circuit, equipped with old-style transformers, showed six to seven amperes in the daytime, while with the new transformers only a fraction of an ampere is shown.

Facts such as these tend to prove not only that constant improvement is taking place in electrical apparatus, but that station managers are realizing that, to secure the most economical results on their systems, such improved apparatus must replace older types built when electrical knowledge had not reached its present high standard. A saving here, less trouble there, the extinction of a difficulty at another point, result in a general benefit which can be exactly calculated in dollars and cents, and tends to the general well-being of the progressive station and communities in which the newer methods are adopted.

New Use for Hoisting Magnets.

A visionary but rather interesting use of electromagnets for lifting purposes has recently been proposed, according to Cassier's Magazine. It is nothing less than the suggestion that the sunken British warship Victoria may be raised by this means. This vessel was rammed and sunk by a sister ship off the harbor of Tripoli over four years ago, and has laid at the bottom of the Mediterranean, with 450 feet of water over it, ever since. The weight of the wreck in water is estimated at 7,000 tons, and the suggested method of raising it is as follows: Powerful hydraulic rams and dynamo-electric machines and a series of heavy electro-magnets are to be arranged on pontoons at the scene of the wreck. A magnet, lowered over the side and coming within reasonable distance of the sunken vessel, would be drawn towards the latter, and, on touching any iron or steel part of it, would immediately stick to it with a power of 100 tons. As each magnet made attachment, which would be indicated by means of an electric dial on the pontoon, a trial pull would be given to the rope to ascertain that a connection had been made to a firm part of the wreck. Should this not be the case, the magnet would come off; its position would be then slightly moved and a fresh attachment made until a firm hold had been taken of the wreck. When all the magnets had been thus fixed, the wreck would be considered ready for raising. Each lifting rope would be attached to the lifting pontoon by means of a sheave on the head of a hydraulic lifting ram having a stroke of 12 feet, which would give an effective lift of 24 feet. Each hydraulic cylinder on the pontoon would be in connection with all the others, and a balancing accumulator would prevent any rope getting more than a normal strain of 100 tons. When the rams had made their full stroke the lifting ropes would all be simultaneously held in position by means of special hydraulic lifting blocks. The rams would then be lowered and another lift of 24 feet given to the wreck, and the operation would be repeated until the wreck would be raised sufficiently near to the surface to be towed to shallower water and there beached. It is estimated that such an undertaking would cost nearly $500,000.

Electric Light Blindness.

[From the Youth's Companion.]

There is a peculiar form of eye trouble caused by exposure of the unprotected eyes to an intense electric light, especially that produced during the fusion of metal by electricity, which has received the name of "electric light blindness."

The trouble begins usually with a feeling of slight pricking and irritation, as if there were fine cinders in the eyes, and this is followed by a persistent overflow of tears and a mistiness of the sight, as if the sufferer were in a fog. The pain, in all but very slight attacks, increases rapidly, and there follows an agonizing aching of the eyeballs, intolerance of light, and often a most distressing spasm of the eyelids. The sight sometimes grows so dim that the patient is nearly blind.

If this accident happens to one who is not regularly employed in electric smelting or drilling, but has merely stopped to look on at the work, the trouble is likely to be thought much more serious than it really is, for the true cause is apt to be overlooked, the intense brilliancy of the light having been masked more or less by the daylight.

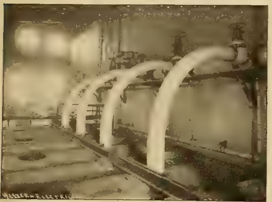
The condition is very similar in its symptoms to that known as "snow blindness," from which hunters in the far north and mountain climbers often suffer, and it is probably an identical affection, namely, a sunburn—in this case an electric burn of the conjunctiva. Firemen frequently suffer in much the same way after working for several hours to subdue a fierce conflagration.

Men who are employed in electric smelting or drilling works always protect their eyes by dark glasses, and the Eskimos do the same by goggles of wood with a slit in the center.

The distress during an attack may be relieved by instillations of cocaine under the direction of a physician, although this drug should not be used when repeated attacks occur, as in the case of firemen, for fear of creating a habit. After the acute inflammation has subsided a simple eyewash of camphor water containing a little borax in solution will usually suffice for a cure.

Nonpareil Cork Pipe Covering.

This material is composed entirely of cork compressed into any form desired in cast-iron molds and baked in a temperature of about 500° Fahrenheit for from eight to 48 hours, according to the mass of material in the mold. This is done without adding any foreign cementing substance whatever, but a natural gum in the cork unites the granulated particles into a solid mass, which remains permanent after cooling. It will readily be seen that as no cement of any kind is used, there is no tendency on the part of the material to disintegrate under the action of water, heat or vibrations. Essential



NONPAREIL CORK PIPE COVERING.

requirements in any pipe covering are high non-conducting power, which cork has in a very marked degree, ability to resist the action of external moisture or leaks in the pipes on which it may be used, and an elasticity which will prevent its being injured by the inevitable vibration to be found in almost all steam lines. In these particulars the superiority of Nonpareil covering is admitted. The durability of the material is attested by the fact that cork steam-pipe coverings in different forms have been in general use throughout Europe for 20 years—England and Germany, the two leading manufacturing countries, having them in most general use—and they stand in high favor there to-day. Experiments extending over a period of three years corroborate the opinion of German and English users of this material, and practical experience has shown it to be especially applicable to electrical work. The coverings at the Berlin, Conn., power house of the New York, New Haven and Hartford Railroad company, which are illustrated herewith, are of this material. The New England Engineering company, which had experience with this covering in the Stamford, Conn., electric plant, was so well pleased that it has ordered the new plant of the New London, Conn., company covered in the same manner. Another notable example is the steam-pipe covering in the new Astor Hotel, Thirty fourth street and Fifth avenue, New York. In that plant over 12 miles of Nonpareil cork sectional covering for steam piping was used, and between two and three miles of coverings for the refrigerating pipes.

Another form which should be of special interest to the electrical trade is the sheet cork to be used beneath the bed plates of high-speed engines, dynamos, etc., to take up the vibration. Still another form that will interest the electrical trade is the heavy compressed cork blocks for use in friction clutches in place of the customary maple blocks. It is a matter of common knowledge that there is frequent trouble with the large clutches used in a great many central stations on account of the inability of the maple to furnish sufficient friction to keep the clutches from slipping, and if the clutch slips at all when thrown into action, the face of the maple is very rapidly burned to a smooth surface, greatly decreasing its natural friction. This does not happen with cork blocks, and actual experience has shown that under the same conditions their life is from five to 10 times as long as maple blocks, and that with the same tension on the [illegible] they will impart from 10 to 25 per [illegible] without slipping. Moreover, if the clutch is overloaded, and does slip, the cork will not acquire that glazed surface which deprives the maple block of its usefulness. In spite of the heavy pressure on these blocks, there is enough elasticity remaining to make them bind tightly when the clutch is thrown into action, and this, added to the friction there is in any cork surface, gives the results mentioned.

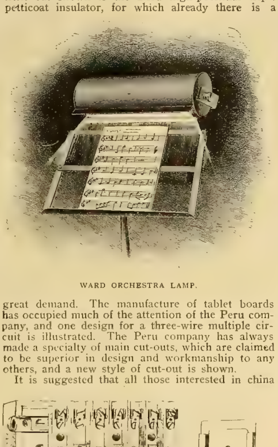
The Nonpareil Cork Manufacturing company of New York controls this product. It has well-equipped factories at Bridgeport, Conn., and is meeting much encouragement from progressive engineers.

Ward Orchestra Lamp.

The cut clearly explains the use of this fixture, which is put on the market by McLeod, Ward & Co. of 27 Thames street, New York. The cylinder usually furnished is supplied with a socket for a 16 candle power lamp. The cylinder is pivoted on the ends and may be revolved in any direction. The cylinder is composed of two pieces, one of which revolves inside the other, so that any desired opening may be obtained, depending on volume of light required. This device, although called an orchestra lamp, is just as valuable for lighting pulpits and pictures. The rector of St. Thomas' Church, New York, experimented with several devices for lighting his pulpit, but, it is said, did not find anything satisfactory until the Ward orchestra lamp was installed. It is fitted with an adjustable clamp for attaching to music racks.

New Peru China Specialties.

The accompanying cuts show a few of the new specialties just placed on the market by the Peru Electric Manufacturing company of Peru, Ind. This company, as almost everyone in the electrical business knows, has developed a fine line of china specialties, and its goods are used all over the country. The cut to the left in the group shows the latest porcelain transformer fuse plug, which, it is said, has given the best results on 2,000 volts. The next cut shown is the Peru high-potential triple petticoat insulator, for which already there is a



WARD ORCHESTRA LAMP.

great demand. The manufacture of tablet boards has occupied much of the attention of the Peru company, and one design for a three-wire multiple circuit is illustrated. The Peru company has always made a specialty of main cut-outs, which are claimed to be superior in design and workmanship to any others, and a new style of cut-out is shown.

It is suggested that all those interested in china specialties of this kind write for further information to the Peru company.

NEW PERU CHINA SPECIALTIES.

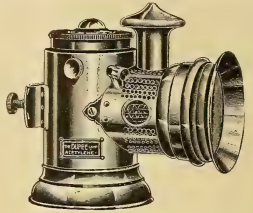
Three Electric Buttons; One Deadly.

[From the San Francisco Examiner.]

Honolulu, December 9.—For the first time in eight years there will be a hanging in Honolulu. The man whose life will be surrendered on the gallows is a Hawaiian named Noa. He will be executed Monday next. Noa's victim was a Chinese storekeeper of the island of Molakai. The scaffold is up and all is in readiness for the hanging. There are three electric push buttons connected with the arrangement, set in a table in a distant building in the prison yard. Three prison wardens will touch them when the word is given. One of the buttons will open the death trap. No man, save the electrician who put them in, knows which one that is.

Dupee Acetylene Bicycle Lamp.

An illustration is herewith presented of the Dupee non-pressure acetylene gas bicycle lamp, which has just been brought out by the White Manufacturing company, 158 Indiana street, Chicago. Prominent features in this lamp are the interchangeability of the various parts and the simplicity of operation. If an accident occurs, such as a collision or an upset, and the lamp be damaged, the injured parts can easily be replaced. It may be stated, however, as proof of the very practical manner in which it is constructed, that samples of this lamp which were



DUPEE ACETYLENE BICYCLE LAMP.

being tested on bicycles and were completely crushed out of their original shape continued to operate as though no harm had been done.

In this lamp the carbide is used in granulated form and is placed in an inside removable cylinder, perforated to permit water to penetrate it. The water is poured into an exterior reservoir, completely surrounding the carbide cylinder, through an opening shown in the cut on the upper part of the side. This opening is covered by a screw cap. The flow of water is regulated by a lever placed at the bottom of the lamp, on the opposite side, and therefore not visible in the cut. Shutting off the water stops the generation of gas, and increasing the flow causes a more rapid generation and a brighter light. The water flows upward through an aperture in the reservoir at the bottom of the cylinder, and as soon as it touches the carbide the gas begins to generate. It is then conducted through a short tube to the burner or passes through the water-jacket to a hole in the top of the reservoir and thus escapes. This avoids the accumulation of gas in the lamp to produce pressure; hence liability to explosion is prevented. While the lamp is burning no more gas is generated than can be consumed. Should a rider stop on the road and extinguish his lamp, the carbide cylinder can easily be taken out before he remounts and the consumed carbide removed from the bottom, so that gas will be instantly generated when the water is turned on, without loss of time waiting for water to percolate through the ashes to the good carbide. The capacity of the carbide cylinder is four ounces, but the lamp need not be charged to its full limit to insure perfect operation. It consumes about half an ounce in an hour.

The Dupee lamp is manufactured with the utmost care. The shells and body parts are all drawn from sheet metal. Rivets and screws are exclusively used for connecting all parts, no solder being employed. The front ring is fastened to the body of the lamp by a bayonet lock, to enable it to be easily taken off, when the reflector can be lifted out to be polished. The reflector is parabolic, that form giving the best results. A bracket is furnished for attaching the lamp to the head of the bicycle. It should not be placed on the fork or axle, as the light is so intense that a wider area is illuminated when on the head. It will not blow or jar out. The reflector and chimney top are made of aluminum to prevent discoloration by heat, but all other parts are handsomely nickeled. Red and green "jewels" ornament the sides.

Long Trolley Rides.

[From the Boston Herald.]

A local paper, in an article on the electrical street-car systems of Eastern Massachusetts, gives a description of what is alleged to be the longest trolley trip in the world, it being run from Providence, R. I., to Nashua, N. H., through Boston. The start, according to the author's route, is from Market Square, Providence, thence through Pawtucket and North Attleboro to Plainville, the only break being between Plainville and Norwood, which is at least 14 miles in length. An extension of the Norfolk Central line from Norwood to Walpole will be in operation within a very short time, but even then it will only reduce the break about 3½ miles. The Norfolk Southern street railway has been granted locations through the towns of Norwood, Foxboro and Mansfield, but it is hard to say when this line will be built. When it is in operation there would still be a distance of 3½ miles between Foxboro and Plainville, which would have to be covered by carriage.

But, even if this line was really in operation, covering a distance of 110 miles, it would not be the longest trolley ride in the world, as it is pos-

sible to make a trip of 124 miles over lines in actual operation, viz.: From the residence of Henry H. Rogers, vice-president of the Standard Oil company, at Fort Phœnix, in Fairhaven, to Nashua, N. H., the route being through New Bedford, Fall River, Taunton, Bridgewater, Brockton, Braintree, Quincy to Boston, and then through Malden, Melrose, Wakefield, Reading, Wilmington, Billerica, Lowell, Dracut to Nashua.

The only break in this line is from Bowensville, a part of Fall River, over Slade's Ferry Bridge, a distance of about one mile. This connection is made by means of a coach which meets every car, free transfers being given. The tracks are now being laid, and it will be but a short time before the entire distance will be connected by rail.

Mexican Telegraph Changes.

An arrangement is said to have been made between the Mexican government and the Western Union Telegraph company by which all telegraph business between Mexico and the rest of the world shall be handled by the Mexican federal telegraph lines and those of the Western Union company, to the exclusion of all other lines. By the terms of this arrangement all dispatches are to be transmitted by the Western Union at Laredo and El Paso, Texas, and from the Mexican federal lines to the cable at Galveston.

The reason that led the Mexican government to make this arrangement with the Western Union is said to have been the fact that the telegraph lines owned by the Mexican railroad companies have been for some time violating their concessions. It seems that each railroad company in Mexico has a telegraph line which it owns. By the terms of the concessions from the Mexican government these lines are permitted to transmit railroad business only. The railroad companies, it is said, have repeatedly violated their agreement with the government. Some of these lines have connections with the Postal Telegraph company and others with the Western Union.

When General Manager Chandler of the Postal Telegraph company was asked by a reporter what he knew about this arrangement, he said:

"I know that some time ago an arrangement was made between the Western Union Telegraph company and the Mexican Telegraph company, which is controlled by the Mexican government, for an exchange of business. I have not heard that the result of this arrangement would exclude all other telegraph companies from doing business in Mexico. If such were the case I think I should have heard of it. I know that there has been some controversy between the Mexican government and the railway telegraph lines over the interpretation of the language of the concessions made by the government to these lines. I know also that some legal arguments on the question have been made. I have read the articles of concession and, if the English language means anything, it seems to me that the articles of concession give the railway telegraphs perfect right to handle commercial business. However, this is a question that must be settled between the Mexican government and the railroad companies, and one in which the Postal Telegraph company is not particularly interested."

Illinois Street Railway Association.

In response to an invitation addressed to the street railway companies of this state, representatives from all parts of Illinois met at the Great Northern Hotel in Chicago, on January 5th, and formed the Illinois Street Railway association. The following-named officers were elected: President, W. H. Patterson, Bloomington; vice-president, L. Sherwood, Elgin; secretary and treasurer, T. J. Minary, Springfield; executive committee, W. H. Patterson, C. K. Minary, L Sherwood, W. L. Ferguson, Decatur; B. F. Harris, Champaign; J. Barker, Peoria, and W. F. Brennan, Chicago.

The constitution as adopted set forth as the aim of the association the closer affiliation of all street railway companies in the state for the purpose of improving methods of construction and maintenance of railways. It is intended to hold yearly meetings, when papers will be read upon recent improvements and devices in track construction, correct appliance of motive power, electric equipments and economic devices which will tend to lessen the expense of car locomotion.

City Restrained from Building Lighting Plant.

Judge Tuley has decided that the city of Chicago is in the wrong in attempting to expend $150,000 on special appropriation for municipal lighting plants and extensions. The council appropriated the money by a special ordinance; the mayor approved the measure; the controller and city electrician prepared specifications and received bids; but now the court, on application of one Charles M. Nicholls, who brought suit as a taxpayer, holds that the whole proceeding is illegal. The judge says: "The statute is too plain for any argument really upon the question. That ordinance is invalid; the appropriation that is intended to be made by it is invalid and the injunction must issue as prayed for." Thus the money is considered as not appropriated and the whole matter will probably be dropped, as it is not considered likely that the city will take an appeal.

CORRESPONDENCE.

New York Notes.

New York, January 4.—Owing to the adverse attitude of Mayor Van Wyck, who insists that the margin of the city's debt-incurring power is not such as to allow it to proceed with the underground road, and suggests as a solution of the transit problem that a demand should be made upon the existing lines to improve and extend their systems, and that the elevated railroad companies should be compelled to substitute electricity for steam, the principal dependence of the friends of the tunnel scheme lies in the Metropolitan Street Railway company. That company is considering the plans of the Rapid Transit Commission, and should it resolve to secure the construction of the road, it is not believed that the city administration would oppose it. Other building syndicates have been mentioned, but undoubtedly the street railway company is in the best position of all to undertake the work. On the part of the Rapid Transit commissioners, the next step will probably be an application to the Appellate Division of the Supreme Court to modify or interpret the $15,000,000 bond stipulation so that the bond will only be required to cover the period of construction.

One of the last acts of the Gas Commission, which went out of existence with the year, was the awarding of contracts, tentatively, for city lighting this year. This work now devolves on the commissioner of public buildings, lighting and supplies, under the new charter. The budget for street lighting being over $106,000 short of the amount required to pay for all the lights decided on, the amount appropriated being $1,290,360, and the money needed, when the bids were tabulated, $1,396,594, the successful bidders were informed by the commission that they would have to go to the new Board of Estimate and Board of Public Improvements for the deficiency. The electric lighting of the city was awarded as follows: Brush Electric company, 91 arc lights at 45 cents a night and 975 arc lights at 40 cents; Mount Morris Electric company, 630 arc lights at 40 cents and 194 arc lights at 45 cents (this company will light the Harlem Speedway); Manhattan Electric Light company, 10 arc lights at 50 cents and 840 arc lights at 40 cents (this company will light Park avenue under the elevated structure of the New York Central in Harlem with 100 incandescent electric lights at $22.50 a year for each light); Harlem Lighting company, 66 arc lights at 40 cents and 19 arc lights at 50 cents; Edison Electric Light and Power company, 524 arc lights at 40 cents and 363 arc lights at 50 cents; North River Electric Light and Power company, 1,052 arc lights at 45 cents; Pelham Electric company, 95 arc lights at 40 cents. It is interesting to note that the Welsbach Street Lighing company of America was given the contract to light Central Park with 500 naphtha lamps at $30 a year for each lamp.

When Mayor Wurster of Brooklyn vetoed the aldermanic resolution granting a franchise in perpetuity to the Municipal Electric Light company for the use of the streets of Brooklyn, James Matthews, a taxpayer, securing an injunction restraining the Board of Aldermen from overriding the veto. Justice Van Wyck in the Supreme Court, on December 30th, modified the injunction, so that the aldermen could grant the franchise for a period not exceeding 25 years, as provided for in the charter of the Greater New York. Thirty minutes later the aldermen met, and were about to grant a franchise, when an injunction granted by Justice Van Wyck to Albert J. Young, a taxpayer, was served upon President Stewart, restraining the board from granting franchises of any character to any corporation.

The Brooklyn Heights Railroad company has practically decided to put a number of double deckers on its Sea Beach route next summer, attached to the motor cars as trailers. The company recently acquired this line and will soon equip it with electricity. It extends from the Bay Ridge shore, at the foot of Sixty-fifth street, to Coney Island.

Among the appointments made by Mayor Van Wyck is that of commissioner of public buildings, lighting and supplies. Henry S. Kearney secures this plum, which is good for six years at $7,500 per year.

It is expected that the Brooklyn trolley cars will be running regularly across the East River bridge by Saturday night. It is thought that this improvement will be of great benefit to the thousands of working people who use the bridge daily.

M. S.

PERSONAL.

Marshall Scobey of the Western Electric company's electrical supply department entertained a number of his Chicago electrical friends on his birthday.

James Dredge, editor of Engineering, London, and one of the English commissioners at the World's Fair in 1893, was created a companion of the Order of St. Michael and St. George in the distribution of New Years honors in Great Britain.

Major Benjamin Butterworth, the commissioner of patents, is very ill at Thomasville, Ga. A recent attack of pneumonia left him very weak, but his present illness is said to be caused by a kidney complaint. His family and other relatives are at his bedside.

S. G. McMeen, the engineer of the Central Union Telephone company of Chicago, was united in marriage to Miss Auta Judith Proctor at Ashtabula, O., on December 22d. Mr. McMeen is a director of the Chicago Electrical association, and is popular with his associates. He and his bride receive their friends at 6245 Greenwood avenue, Chicago.

A memorial to the late Prof. J. J. Sylvester is proposed, and an appeal has been made by Raphael Meldola, professor in Finsbury Technical College, London, Eng., who is secretary of the memorial organization. It has been estimated that $5,000 will be sufficient for the proposed endowment, and of this about one-half has already been subscribed. Prof. Meldola says: "In appealing to the American public to enable us to complete the desired sum I am, in the first place, prompted by the consideration that Sylvester's association with the Johns Hopkins University and the leading part which he took in advancing mathematical science in America render his claim to estimation on the part of the citizens of your country quite a special one. It is proposed that the fund when complete shall be transferred to the Council of the Royal Society of London, that body having undertaken to accept the trust and to award the medal triennially to mathematicians of all countries."

The wedding of Prof. Alexander Melville Bell, the father of Alexander Graham Bell, the inventor of the telephone, to Mrs. Harriet G. Shibley of Harrowsmith, Ontario, on January 1st. at the Park Avenue Hotel, New York, was private, and only a few friends and relatives were present. The Rev. Dr. Patterson of Binghamton, who is Prof. Bell's oldest living pupil, performed the ceremony. The Hon. John Hitz was best man, and Mrs. Shibley was attended by her niece, Miss Hattie Mace of Tamsworth, Ont. The other guests were Alexander Graham Bell, his daughter, Miss Elsie Bell; D. C. Bell, brother of the bridegroom; C. C. Shayne and Harris Guest. Profesor Bell was born in Edinburg, March 1, 1819. For 22 years he was a lecturer at Edinburg University and at New College. Later he lectured in the London University, and in 1870 came to Kingston, Canada, and lectured in Queen's College, in that place. In 1881 he removed to Washington, where he has since lived. His wife is 25 years his junior.

ELECTRIC LIGHTING.

From Berlin, under date of January 4th, is sent the statement that the German Transoceanic Electric company has been formed, with a capital of 10,000,000 marks, for the purpose of erecting electrical stations in America. A central station will first be established at Buenos Ayres for lighting and general supply.

The Board of Trustees of College Point, L. I., on December 30th signed a contract with the Flushing Electric Light and Power company for 87 arc lights for five years. The bills will be presented to Greater New York for payment. The work of putting up the poles was started immediately upon the signing of the contract.

Whitehall, Wis., is said to be the smallest village in that state having an electric light plant. The installation includes a 50 horse power turbine water wheel, a 450-light dynamo, several inclosed arc lamps on the streets and about 200 16 candle power lights in stores and dwellings. The Whitehall Times says: "We question whether there is another plant in the state that furnishes 16 candle power electric lights at one cent a night each, which is the cost of ours."

For several months the Hot Springs, Ark., water, gas and electric light companies have been making an effort to reach an agreement with the city whereby they would receive pay for services rendered from month to month. The question has been submitted to the City Council several times recently, but nothing definite was done. The propositions were rejected December 23d, and the mayor has been served with notices that the water and lights will be turned off at once, and employes of the companies have been engaged in dismantling the water plugs and removing the arc lamps from the poles.

On December 28th the village of Mount Morris, N. Y., held a special election to vote on the proposition to extend the present contract with the Mount Morris Illuminating company for a period of five years from April 10, 1900. The subject aroused but little interest, it would seem from the vote, for all the matter was quite important. The total vote cast was 130, of which 111 were for and 28 against. The condition and circumstances that led to the early action on a contract that has yet two years to run were that some time ago a company of capitalists offered to put in a new water power dam on the Genesee River where the one was washed out last

spring, if the race company would sign over its water rights to the new company and agree to take so many shares of the company's stock at a certain price. All interested agreed to do this but the Mount Morris Illuminating company, which refused to sign it unless the village would extend the contract for street lighting for five years from the time of the expiration; hence the election. Now that the proposition is carried, Mount Morris will once more have a good water power. The present lighting plant is now operated entirely by steam.

A large number of bids for installing the electric light and power plant in the new postoffice building in Washingon, D. C., were opened on December 30th. Some of the bids were for the complete plant, some for switchboard and wiring, others for engines, and a number for dynamos alone, so that no intelligent comparison of prices could be made without an extensive tabulation. Moreover, the specifications allowed bids to be put in on units of varying number and capacity. Among the western bidders were the Fort Wayne Electric corporation, the Chicago Edison company, the Western Electric company, Siemens & Halske Electric company and Arthur Frantzen & Co. of Chicago.

The annual report of the St. Petersburg and Moscow Electric Lighting company, recently published, states that the total gross earnings were $850,000, and the expenses were $500,000. The net receipts amounted to $300,000 and after deducting the cost of administration for both towns there is a profit remaining of $270,000, of which $54,000 is written off for depreciation, $10,800 for government taxes, and $23,000 for the reserve and insurance fund. A dividend at the rate of six per cent. was declared. Several large debts had been paid off during the year, which had reduced the working capital. The erection of the new St. Petersburg station has been retarded, and the station will not be in operation till next summer. The work at the new Moscow station had progressed so that the regular supply of current was started on November 1st. These works, which have a capacity of 20,000 sixteen candle power, will be increased to 40,000 when the enlargement is completed. The length of the streets in which cables have been laid is 33 miles, and next spring it is contemplated to put in 13 miles more, as the applications for connections are very numerous. Since the enlargement of the works commenced, there have been during the year 1,774 new lamps connected in St. Petersburg and 2,888 in Moscow, making the total lamps connected up to date 60,671.

ELECTRIC RAILWAYS.

The plants, franchises and other property of the Milwaukee and Wauwautosa Motor Railway company, the North Greenfield and Wauwautosa Electric Railway company, the Waukesha Electric Railway company and the Waukesha Beach Electric Railway company have been conveyed to the Milwaukee Light, Heat and Traction company, which is owned by the Milwaukee Electric Railway and Light company.

The Board of County Commissioners at Goshen, Ind., December 24th, granted to the Elkhart, Goshen and Southern Railroad company a franchise to run an electric street railroad from Elkhart to Goshen and from Goshen to Waterford, New Paris, Syracuse and Wawasee Lake. The road is to be built within one year. The incorporators are W. H. Holcomb and Herbert Holcomb of Chicago, H. D. Judson, N. J. Aldrich and F. G. Mills of Aurora, Ill.

A trolley car of the Schuykill Valley Traction company was held up by four highwaymen at Swedeland, near Norristown, Pa., December 26th, about 10 o'clock at night. Conductor Charles Galloway refused to give up his money and was shot dead. Three shots were fired at Motorman Matthias, but none took effect. After rifling the body of the conductor of the money and a gold watch the robbers escaped. There were four women in the car, but the highwaymen covered them with their weapons, but made no attempt to rob them.

The Hudson River and Long Island Sound Railway company, with its principal office in New York city, was incorporated at Albany December 29th, with a capital of $100,000, to construct a street surface road to be operated by electricity in Westchester county, about 10 miles in length, from the New York Central station in Yonkers to the village of Pelham Manor, near the New York city line. The directors are Charles C. Bassett of Washington, Henry A. Welch of Detroit, James F. Secor, Jr., of Pelham Manor, D. B. Halstead, Paul Gorham and John H. Seed of Brooklyn, [illegible] Baker and Walter R. Quick of New York city and William [illegible] Stout of Elizabeth, N. J.

Three persons were injured in a trolley-car runaway at Providence, R. I., December 26th, when a Camp street electric car rushed down Olney street hill with the speed of an express train and shot across North Main street into the corner of a frame building. Three persons were injured. The impact of the collision was so great that some of the heavy ironwork on the car was doubled up, and the corner post of the building, which acted as a buffer, was badly splintered. That the occupants of the car escaped with their lives is remarkable.

There were about 10 passengers in the car at the time besides the motorman and conductor. One of the most surprising things was the escape of the motorman, who stuck to his post.

Lyons, France, is considering the advisability of changing the present street railway service to an electric system. It is also determined to extend the service soon to the old section of the city and to the fashionable residence portion of the town. An electric line is to be constructed from Croix-Rousse, the home of the weavers, to Saint Blandine, a distance of five miles. The latter place is near the principal railway station of Lyons. The present steam railroad, nine miles in length, connecting St. Just with Vaugeneray, will soon be changed to an electric line. From Vaugeneray it will be continued a distance of 20 miles to Symphorien-Sur-Ciose. From St. Just there will be an electric line constructed to Francheville-le-Haut, a distance of four miles. An electric line 45 miles in length will connect the Chazelles-sur-Lyon depot with St. Symphorien-sur-Coise, and one of seven miles will extend from Lyons to Chaponost.

Foster & Louis, the Chicago contractors, have sold their contract for the building of the Holland, Mich., electric railway and lighting plant to H. B. Black, I. E. Cockran, Jr., and Mr. Powell, all Chester, Pa., capitalists. At a recent meeting in Chicago of the Holland and Lake Michigan Railway company, Messrs. Humphrey, Larsons and Ferguson were succeeded by the election of new officers, as follows: President, H. B. Black; treasurer, Mr. Powell; secretary, I. E. Cockran, Jr. The stock and bonds were also turned over to the new organization. The city of Holland has extended the franchise, which expired January 1, 1898, to June, 1898. This road, when completed, will be seven miles in length and will operate between Holland, at the head of Black Lake, and Ottawa Beach and Macatawa Park, well-known Michigan summer resorts. The grading, bridges and power house are all completed; the machinery is on the premises, and it will only take some four or five weeks to complete the road ready for operation.

A street-railway transfer line connecting several downtown railroad stations of Chicago will be put in operation soon, it is claimed, by Charles T. Yerkes and the interests which he represents. The stations are the Union passenger station, Adams and Canal streets; the Northwestern station, Wells and Kinzie streets; the Rock Island station, Van Buren street and Pacific avenue; the Polk street station, Dearborn and Polk streets, and the Illinois Central station, in Park row. The new line will be operated by electricity and a five-cent fare will be charged. It is said that special attention will be given to the transfer of small baggage. This will not include the large sample trunks of commercial travelers, nor the almost equally bulky properties of the theatrical tourist. An arrangement may be made by which the transfer system will include connections with the Wisconsin Central station, Fifth avenue and Harrison streets, by means of a transfer at Fifth avenue and Van Buren street.

The Utah American and Foreign Development company of London has undertaken the development of a large section of Utah, through which it intends to build an electric road 82 miles in length. This will connect Ogden, Salt Lake City and Provo, Utah. The district through which the road will run is said to be very rich, both agriculturally and in the line of mineral resources. The road will reach Provo cañon, which forms the only natural outlet for railroads in that direction, and it is expected that steam railroad extensions will be built, the traffic being handled electrically over the 80 miles of the company's lines. It is proposed that the power house will be located between Salt Lake City and Provo and three miles from the former, so that the maximum distance between the power plant and either end of the line will be 42 miles. The plant is designed for 20,000 horse power. There are said to be very extensive iron and coal deposits along the line of the road, which, it is thought, can be successfully developed by means of electric power.

Arrangements for the construction of an extensive electric railway are said to have been completed by the projectors of the Geneva Lake, Sycamore and Southern railway and the projectors of the Kankakee, Wilmington and Morris railway. It is proposed to consolidate the lines and thus form the longest line of electric railway extant. The eastern terminus of the road will be Kankakee, Ill. From this point the road will follow the Kankakee River to Wilmington, and from there to Morris, with a branch to Joliet. From Morris the road will traverse the Fox River Valley, connecting with lines from Elgin and Aurora, to Sycamore and thence to Geneva Lake. This road will penetrate country not at present occupied by any steam lines. The population of the points it will strike and connect with and which it will depend upon for traffic exceeds 500,000. The new line will be constructed through the most picturesque portion of the Mississippi Valley. Right of way from Kankakee to Morris has been secured by capitalists interested in the Kankakee, Wilmington and Morris road.

TELEPHONE.

It is said that the Bell Telephone company will renew its application to the town council of Hampton, Va., to establish an exchange there. The company has been twice refused permission to enter Hampton, but since that time, it seems, public opinion has undergone a change.

Florence, Ala., will soon have telephonic communication with Leighton. The wires are strung to a point within one mile of the Sheffield exchange. The Southern Bell company has also in mind a line from Florence to Cherokee and Riverton, which will be put in operation some time during the winter. The company is also figuring upon extending this line so as to take in Waterloo and Russellville.

The late storm played havoc in Mobile, Ala., with the lines of the Home Telephone company. Poles were blown down in all parts of the city and wires carrying heavy currents fell upon the telephone lines. The switchboard in the telephone exchange began to smoke, showing the presence of a high current, and in order to save it the manager cut the wires, but not until two cables of 100 wires each had been burned out.

A cable dispatch from Berlin, January 1st, says that the annual charge of $37.50 for telephone service will in future be replaced by a yearly rent of $12.50 for the apparatus plus the small charge of about one-fourth of a cent for each conversation by private persons, half a cent for business men and firms and three-quarters of a cent for clubs, cafés, etc. Business men oppose the proposal that they be charged more than others.

Six per cent. bonds of the Central Union Telephone company amounting to $1,200,000, part of an authorized issue of $3,000,000, are offered for sale at 105 and accrued interest. In the statements made to aid the sale of the bonds it is noted that the company holds licenses for all the instruments and apparatus owned or controlled by the American Bell Telephone company in Ohio, Indiana and Illinois, with the exception of a few counties containing large cities, and is operated under the policy of the American Bell Telephone company, which owns more than half of the capital stock of the Central Union Telephone company and also a large part of its bonds. A statement of accountants, accompanying the announcement of the bankers, says that the net earnings of the company for the five years ended December 21, 1896, were $306,784 per year. The net earnings for 1897, partly estimated, were $340,787, or more than double the amount necessary to meet the total interest charge.

By way of a special Christmas treat to the patients of All Souls' Hospital in Morristown, N. J., arrangements were made for them to hear the Christmas Day services at the Church of the Assumption, which is about a mile distant from the hospital. As it was obviously impossible for the bedridden patients to go to the service, the service was brought to them by means of the telephone. Each patient had a receiver, and in this way not only the sermon of Dean Flynn, but also the music and prayers, were heard at the hospital with practically the same distinctness as in the church. The sermon was from the text: "Fear not, for behold I bring you tidings of great joy, which will be to all the people, for this day is born to you in the city of David a Savior, who is Christ the Lord." [Luke ii., 10-11.] This is said to be the first time a Roman Catholic service has been thus transmitted. The patients at the hospital were delighted with the welcome break in the monotony of their life, and the experiment may be repeated shortly.

ELECTRICAL SECURITIES.

Of the $3,000,000 Central Union Telephone company's bonds authorized by the mortgage of July, 1896, $2,500,000 are now outstanding.

The North Chicago Street Railway company has declared its quarterly dividend of three per cent., payable January 15th to stockholders of record January 5th.

The New York and New Jersey Telephone company has declared a quarterly dividend of 1½ per cent. and an extra dividend of one per cent. payable January 15th.

The New Orleans Traction company reports gross earnings for November of $80,042, a decrease of $15,188 as compared with the same month of last year, and net $35,060, a decrease of $6,071. For the 11 months ended November 30th the gross earnings were $1,120,324, a decrease of $83,581 as compared with the corresponding period of last year, and net $354,470, a decrease of $102,741.

The Chicago Edison company has issued another $100,000 of its authorized $600,000 gold bonds, making the total amount now outstanding $2,075,000, all of which bear five per cent. interest. The proceeds arising from the sale of the bonds will be used to pay for recent acquisitions and to make improvements contemplated with a view to the practice of greater economy in operation. With its increased business the company's plants are overtaxed during the busiest hours.

A plan has been proposed for the reorganization of the Nassau railroad system in Brooklyn, which contemplates a new issue of stock and bonds to the amount of $30,000,000, with the bonds on a four instead of a five per cent. basis. A new company will

either be organized or the corporations composing the present system will be merged into the Nassau company. By this plan there would be a saving, it is said, of nearly $200,000 a year alone in rentals to the Kings County Traction company. It is said that a syndicate headed by Banker R. T. Wilson has been organized to undertake the entire reorganization, which will probably extend over a period of two years.

MISCELLANEOUS.

Louis M. Packer of Lynn, who brought suit against the Thomson-Houston Electric company for $100,000 for the loss of both hands in an "undercut" machine at the works of the company nearly two years ago, obtained damages in the sum of $20,000 from a jury in the Superior Court at Salem December 29th.

Secretary Long of the Navy Department has accepted the proposition of the Union Iron Works, San Francisco, to install a central electrical plant on the battleship Wisconsin, now building there, of the same character and at practically the same terms as those recently authorized on the Alabama and the Illinois. This will cost $11,400, which includes an extra $900 for freight to the Pacific coast. The electrical installation will operate the turrets and ammunition hoists of these ships.

Electricity has been put to a new use at the hennery of William B. Beakes, in Newburg, N. Y., according to the New York Sun. On Thursday morning of last week an unknown man was found unconscious and almost frozen at the door of the hennery. William B. Beakes, Jr., who is something of an electrician, had charged the knob on the door with electricity. When the man took hold of the knob he received a shock which rendered him unconscious. When restored, he said he had been looking for shelter for the night, but knew nothing more after touching the knob.

A strange prenomenon at this season of the year was the lightning which flashed from the clouds during the terrific blizzard at Rockland, Me., January 1st. It was to the lightning that Captain Spencer and six men of the crew of the schooner Nevada owe their lives. The Nevada was driven on the high ledges of Griffin's Island at midnight and soon went to pieces. The captain and crew had barely time to launch a small boat when the vessel went down, and they reached the island only after a desperate struggle with the elements, the sharp flashes of lightning showing them where a safe landing could be effected. They were taken off the barren island by the life-saving crew of Tenant's Harbor station, after suffering considerably from exposure to the cold and storm during the night.

TRADE NEWS.

Hodge, Walsh & Loring have removed their establishment to 701 Delaware street, Kansas City, Mo. They sell supplies and do construction and repair work.

New Years would lose something of its hopefulness if "Charlie" Shain's cheery greeting was missing. This year Mr. Shain sends to his friends just 1898 good wishes for the new year.

Owing to lack of shop room, the Hoffman & Billings Manufacturing company of Milwaukee has transferred its Corliss engine business to the Rarig Engineering company of Columbus, O.

As the result of a recent extended trip through the country, Mr. C. O. Baker, Jr., of Newark, N. J., gives it as his opinion that the new year bids fair to be a prosperous one from a business point of view.

The People's Electric company of Madison, Wis., and the Western Electrical company of Omaha, Neb., have lately taken agencies for the Perfection dynamo brush and Rogers' commutator lubricant, hich are manufactured by the Ohio Electric Specialty Manufacturing company of Troy, O.

One of the most unique of the many calendars which we have received this season is presented by General Agent J. P. Williams of 39 Cortlandt street, New York, being a representation of the well-known Paragon fan motor, in colors, half size and with the blades attached separately to the calendar so that they can be moved as desired. Upon each of the four blades is printed three months of the year.

Mr. Edward J. Wessels, who for the last four years has been managing director of the Standard Air Brake company of New York, severed his connection with that concern on January 1st. Mr. Wessels can well be proud of the record he has made in this line of business. The air brake was little known to street-railway men when he took hold of it, and through his incessant work he achieved a deserved success, and the market for this product abroad has been beyond expectations. Mr. Wessels has several business propositions in the electrical line under consideration.

At the regular annual meeting of the Anchor Electric company, 71 Federal street, Boston, it was voted to increase the capital stock to $100,000. Officers were elected as follows: Norman Marshall, G. O. Proctor, G. H. Proctor, Arthur Howland, directors; G. O. Proctor, president; G. H. Proctor, vice-president; Norman Marshall, treasurer and manager; Arthur Howland, secretary. The growth of this wide-awake concern has been very rapid and its present facilities for supplying its well-known specialties are sometimes severely taxed. The merits of the Anchor switches are so generally recognized that it is not necessary to explain how this concern has built up its large trade.

The New Years souvenir of the Partrick & Carter company, or rather Partrick, Carter & Wilkins, as the firm is now known, is a handsome memorandum-book, bound in celluloid and leather, with gilt edges. In sending this tasteful gift to its patrons the firm does so "with the hope that the year which has gone has not dealt harshly with you, and that the year to come will bring to all a fair share of prosperity and happiness." The firm is composed of Franklin S. Carter, Charles M. Wilkins and E. Ward Wilkins. It has been in existence for many years, and in the manufacture and sale of electrical supplies it has a reputation as wide as the country. The address is 125 South Second street, Philadelphia.

A warm and cheerful greeting was extended to visitors at the New York offices of the India Rubber and Gutta Percha Insulating company on the afternoon of December 31st, when the company held its annual reception. The courtesies were extended by General Manager W. M. Habirshaw, who was assisted by J. W. Godfrey, F. W. Harrington and J. P. Olson. A bountiful lunch was provided, with all of the necessary adjuncts of good cheer, and the health of Dr. Habirshaw and the success of his company was drunk many times. A feature in connection with this reception consisted in a number of musical selections by the members of the Redpath Lyceum Bureau, and also some astonishing feats in legerdemain. At six o'clock cabs were ordered, and those that were brave enough to enter them were entertained by a miscellaneous fusillade of old shoes and the like, which led many to believe that something very important had been transpired in the neighborhood of 15 Cortlandt street. In all it was the most successful social gathering that this company has entertained.

The increase in demand for thoroughly reliable apparatus in the electrical trades has resulted in the growth of many concerns which confine themselves exclusively to certain specialties, and are therefore naturally able to become leaders in their respective lines. The question of proper rheostat control for the fields of dynamos and for the starting and regulating of motors, as well as resistances for cauteries, dental lathes and many other applications of the electrical industry, has always been considered of special importance to electrical engineers and builders and users of electrical machinery. Recognizing this principle, the Iron-clad Rheostat company of Westfield, N. J., was formed in the spring of 1895, with the intention of providing the electrical fraternity with the best that could be produced in the rheostat line. Thousands of rheostats, which have given universal satisfaction, have been manufactured by them since that time, and an entire reorganization of the manufacturing as well as the business departments of the company now gives it exceptional facilities for prompt shipment of orders, whether of a standard or special nature. The Iron-clad Rheostat company has recently standardized an entire new line of motor starters and will be pleased to furnish prices, give information, etc., to .ybody interested.

Writing of the general business situation, Mr. John A. Walker, the vice-president of the Joseph Dixon Crucible company of Jersey City, says: "In 1893 it was a case of business paralysis, in 1894 we had a year of debility, in 1895 the patient partially revived, in 1896 came a relapse, but in 1897 came recovery and the patient took up his bed and walked. The great medicine man was dollar wheat and 30-cent corn, plus poor harvests at this exigency abroad. I saw it myself, for in November I visited Indianapolis, Cincinnati, Chicago, Omaha, Denver, Kansas City, Pueblo and St. Louis, and saw everyone up to his eyes in new business. The consumer at last had money once more, and was spending it. The industrial triumphs of 1897 are important. In this year the business cloud passed away and another era of prosperity, hopefully of long duration, opened. Export trade was larger in the fruits of the harvest, and particularly in manufactured goods, than in the history of the country. Americans are competing in every market. American motors won the order in London. On a bridge in Holland an American firm was the lowest bidder. American steel rails go regularly to China, Japan and India. A movement is on foot to have the English Parliament pass a law changing the stamp on goods not made in England to "Abroad" instead of the name of the country where they are made. This is an effort on the part of the English law-makers to obscure the origin of these goods. For the Dixon company personally, we have shared in the general prosperity. The year has been an agreeable one, the future looks rosy to those who have eyes to see. Perhaps the outlook was never more inviting. Never were there so many roads open to wealth to those who know how to find them."

BUSINESS.

The Western Electric company has a large and most complete supply of interior conduit in stock in its Chicago warerooms.

A folder showing the advantages of Rainbow, Honest John and other steam packing may be had on application to the Peerless Rubber Manufacturing company, 16 Warren street, New York.

A good general battery catalogue is that of the Gordon-Burnham Battery company, 82 to 86 West Broadway, New York, lessee of the Law Battery company. The Gordon and Law cells are described, and also many accessories and apparatus supplied with current from primary batteries, both for medical and general use.

A very handsome battery catalogue is that of the Chloride of Silver Dry Cell Battery company of Baltimore, which has just been issued. It is devoted to medical batteries, and certainly should arrest the attention of physician and supply dealer. A large number of sets and combinations and many appliances for electro-medical work are shown.

The battery and specialty department of the National Carbon company of Cleveland has been so crowded with orders that the company has been obliged to nearly double its force. A large number of new carbon specialties, in the way of back plates and transmitter parts, have been added to the company's already long list, and the National people are prepared to make anything desired in the specialty line on short notice.

Proprietor D. A. Kusel of the D. A. Kusel Telephone and Electric Manufacturing company of St. Louis reports a nice business on the opening of the new year. The company has just closed a contract for a county line, including all material, construction and instruments, from Columbia, Mo., to Jefferson City, Mo., taking in all intermediate points. This line will require some 30 long-distance telephones and be completed in about a month.

Three diplomas of merit to one concern shows pretty well what the judges of the Tennessee Centennial Exposition think of the Robertson-Thompson indicator, Lippincott planimeter and Eureka packing. James L. Robertson & Sons, New York, entered these three articles and were awarded the diplomas. They say that if engineers and steam users would send for illustrations and descriptions of these goods it would not only be of interest but profit.

The Electric Appliance company, Chicago, reports that its new issue of General Catalogue No. 12 is now very generally distributed all over the country and is producing very satisfactory results. Certainly very few buyers could resist the temptation of ordering from such a handsome and useful publication. The Electric Appliance company is entitled to all the good that its catalogue may bring to it, as the production involved much work and expense.

The Morrell Electric Works, 25 South Eighth street, St. Louis, is now pushing the branch of its business devoted especially to the manufacture of standard street-railway motor commutators, and also formed armature coils for street-railway motors. These coils are prepared by the Morrell Works by a process similar to that employed in the best factories, and each coil is of an exact size and so shaped on an accurate die that it may be instantly, on receipt by the user, slipped into position on armature. The Morrell Works is also energetically pushing general repair work on transformers and other electrical apparatus.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 28, 1897.

596,054. Electric Railway. Eben C. Crocker, Bridgeport, Conn. Application filed April 23, 1897.

This system comprises a supply conductor, a third rail consisting of insulated sections and a power collector carried by the car, two series of double wound magnets arranged in horizontally disposed couplets, the magnets of one series being connected in quarternate pairs in circuit with pairs of alternate magnets of the other series, and connections with the conductor and sections through intermediate circuit closers and breakers operated by the magnets, whereby the section having contact with the collector is in closed circuit while the sections immediately succeeding and preceding are in circuits capable of being closed by the collector.

596,085. Electrical Signal Bell for Street Cars. James P. Orr, Pittsburg, and Th[illegible] vin, McKeesport, Pa. Application f[illegible] 3, 1896.

In an electric signal bell there is the [illegible] bell clapper and its arm, a ratchet [illegible] friction rollers adapted to engage the [illegible] and an automatic circuit opener with [illegible]

vibrating armature, and a pawl pivotally mounted on the end of the armature which is adapted to engage and propel the wheel

596,131. Trolley. Antonio Travaglini, Philadelphia, Pa. Application filed November 13, 1896.

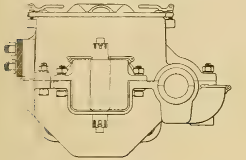
The device comprises a pole, a spindle thereon, a trolley wheel journaled on the spindle, a sleeve carrying a pin slidable on the spindle, and a screw secured to the pole adapted to operate the sleeve.

596,134. Signaling Circuit for Fire and Police Systems. Albert Barrett, Kansas City, Mo. Application filed September 9, 1897.

The box has a door adapted to swing outwardly and provided with a lock, having a concealed circuit-closing pin and springs in the path of the pin, a clock-train is adapted to be wound by the closure of the door and to be released by the opening of the same to serially rotate a brake-wheel and to operate a circuit-closer; telelephone instruments are also provided.

596,135. Securing Device for Covers of Dynamo-electric Machines. Norman C. Bassett, Lynn, Mass. Application filed March 27, 1897.

An inclosing case for a dynamo-electric machine has a removable cover with slotted ends, screw-threaded supports secured to the case, handles pivotally secured to the supports, and laterally projecting cams on the handles resting on the cover adjacent to the slots, so arranged that when the handle is thrown to its open position they are out of the path of the cover so that it can be removed.



NO. 596,135.

596,136. Armature Winding and Coil. Asa F. Batchelder, Schenectady, N. Y. Application filed September 15, 1897.

A coil for a dynamo-electric armature has the sides to be disposed on the armature face united at least at one end by three end portions, two of which are involutes offset from one another, and the third a spiral.

596,152. Detachable Laminated Pole-piece for Dynamo-electric Machines. Henry Geisenhöner, Schenectady, N. Y. Application filed October 11, 1897.

In a revolving field-magnet structure for dynamo-electric machines the combination is claimed of laminated detachable field-poles having split dovetail projections at one end, a support having dovetail slots extending parallel to the shaft of the machine in which the poles are mounted, and wedges for expanding the dovetail projections of the poles.

596,157. Apparatus for Electrolytically Producing Alkalies. James Hargreaves, Widnes, England. Application filed March 16, 1896. Patented in England September 27, 1893.

An electrolytic cell having compartments separated by a diaphragm which, although slightly porous, is impermeable as a filter, an anode, a cathode of open texture, such as wire-gauze, in contact with the face of the diaphragm remote from the anode, and means, such as a steam generator, for supplying steam which becomes condensed upon or for directing a current of steam against the uncovered face of the cathode.

596,160. Electric Heater. Hugo Helberger, Munich, Germany. Application filed April 29, 1896. Patented in Germany June 10, 1894; in England July 13, 1894; in Switzerland October 17, 1895; in Belgium October 29, 1895; in Italy October 31, 1895, and in Hungary November 9, 1895.

The body to be heated is a conductor of electricity with a wire surrounding it, a series of beads of refractory material strung upon the wire and in contact with the body to be heated and a layer of refractory material outside the beads.

596,172. Lead for Electrical Sounding. Julius Mohs, Brandenburg, Germany. Application filed September 3, 1896. Patented in Germany February 23, 1895, and in France December 17, 1895.

It is proposed to employ a pair of contact devices, a shoe pivotally connected to the front end of the body and extending beneath [illegible] and means operated by the movement of the shoe [illegible] a circuit through the contact devices.

596,182. Electric Railway. William B. Potter, Schenectady, [illegible] Application filed November 18, 1896.

Sectional conductors [illegible] switches for closing the circuit between the conductors and a source of supply, means carried by the moving train or vehicle for closing the sections in advance of the train and additional means independent of the switch for closing the circuit between the sectional conductors and the source of supply are here combined.

596,186. Phase Regulator. Charles P. Steinmetz, Lynn, and Edwin W. Rice, Jr., Swampscott, Mass. Application filed September [illegible]

The phase controller [illegible] member connected to [illegible] alternating current circuit [illegible] an induced member [illegible] of relative rotation [illegible] and means for varying the self-induction [illegible] to vary the phase control.

596,190. Induction Wattmeter. [illegible] Thomson, Swampscott, and William H. Pratt, Lynn, Mass. Application filed [illegible] 1897.

A field magnet structure [illegible] frame with poles for the current and potential [illegible] at points [illegible] degrees apart, a cylindrical armature [illegible] magnet structure whose magnetic circuit is completed through certain of the poles on the external frame.

596,197. Electrical Protective Appliance. Arthur S. Williams, Newton, Mass. Application filed August 26, 1897.

The inventor claims a combination in an electro-magnetic appliance of the winding thereof, a mass of easily fusible material contiguous thereto, a sheet metal heat-collector contiguous to the winding and also to the fusible mass, and circuit-changing devices controlling protective connections.

596,201. Electrical Signaling System. John P. Buchanan, Boston, Mass. Application filed December 27, 1893.

A block-signal system is described, having a track circuit and a generator at one end of the block, and being provided with a plurality of relays located at different distances from the generator and adapted to be successively short-circuited through a passing train, and signaling mechanism having circuits controlled by the relays.

596,224. Trolley Rail. William A. P. Willard, Jr., Hull, Mass. Application filed February 12, 1897.

A conductor and a truck normally out of electric contact with it and adapted to have a limited longitudinal movement in either direction into electrical contact with the conductor, the truck being mounted upon rolls and capable of movement upon the contact therewith of a contact shoe.

596,225. Trolley Rail for Electric Roads. William A. P. Willard, Jr., Hull, Mass. Application filed March 5, 1897.

The trolley-rail mechanism described consists of a contact rail suitably supported and capable of traveling longitudinally, and an electric conductor normally insulated therefrom, and means whereby, when the rail travels longitudinally, electric contact will be established between the contact rail and conductor.

596,226. Electric Signaling System. Adoniram J. Wilson, Port Chester, N. Y. Application filed December 21, 1895.

The track is divided into blocks, with track circuits for the blocks, home and distant signals normally at "danger" for the blocks, a home signal and a distant signal being located at the entrance of each block, each home and distant signal having a separate motor peculiar to itself, normally de-energized signal circuits for the signals controlled by the track circuits, the arrangement being such that a train operates the signals in advance to put them to "safety," the train being guarded in the rear by a home signal at "danger" and two distant signals at "danger."

596,229. Underground Junction Box for Electric Conductors. William F. Bossert, Utica, N. Y. Application filed February 17, 1897.

The insulating stuffing-box consists of a body portion, an insulator bushing held therein, a cap, an insulator bushing held therein and an elastic packing between the adjacent ends of the bushings.

596,236. Electric Gas Lighting Device. Adrian L. Bogart, New York, N. Y., and Le Roy S. White, Waterbury, Conn. Application filed May 7, 1897.

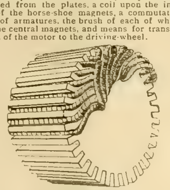
This is an electric gas-lighting and extinguishing device containing a gas-supply controlling valve provided with a stem, an armature secured to the stem, an electro-magnet for actuating the armature to open and close the valve, an igniting tube, an auxiliary gas-supply controlling valve therefor, the auxiliary valve being located in position to be engaged and opened by the armature when the electro-magnet is energized, and a sparking device under the control of the movement of the auxiliary valve.

596,250. Fire Telegraph Repeater. Francis A. Skelton, Newton, Mass. Application filed July 3, 1893.

A supplementary battery and suitable contact devices are connected to the several circuits for connecting the supplementary battery in the circuits successively and momentarily.

596,272. Electric Bicycle. Hosea W. Libbey, Boston, Mass. Application filed November 8, 1895.

An electric battery and a motor comprising a series of straight, parallel, central, permanent field-magnets, having their poles arranged alternately with each other, a shaft having its axis concentric with the magnets, a plate upon the shaft on each side of the magnets, a series of armatures for each plate, each series of armatures consisting of a pair of horse-shoe magnets passed through and insulated from the plates, a coil upon the inner end of each of the horse-shoe magnets, a commutator for each series of armatures, the brush of each of which engages with the central magnets, and means for transmitting the motion of the motor to the driving-wheel.



NO. 596,136.

596,273. Electric Bicycle. Hosea W. Libbey, Boston, Mass. Application filed December 14, 1895.

A portion of the frame is bifurcated and carries an electric battery, with a motor upon each side of the bifurcation of the frame, an axle in the bifurcated portion common to both of the motors, and a bifurcated pitman connecting the crank shaft with the driving wheel.

596,274. Electric Bicycle. Hosea W. Libbey, Boston, Mass. Application filed December 14, 1895.

A frame is provided with a vertical rear fork and a double motor upon the fork, means are also provided for communicating motion from either one or both of the motors to the driving-wheel, a double electrical battery upon the frame and from either of the motors to the driving-wheel of the bicycle in a line with the rear fork.

596,276. Telephoning from Cars in Motion. Hosea W. Libbey, Boston, Mass. Application filed April 6, 1897.

One claim is given: In a railroad car wheel having a ring of conducting material let into the edge of its flange but insulated therefrom, and a ring of conducting material attached to the inner side of the flange but insulated therefrom.

596,283. Electric Current Meter. Reginald P. Wilson, London, England. Application filed March 24, 1897.

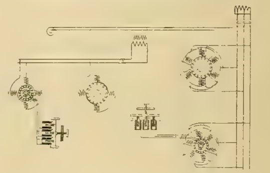
A device for automatically changing the position of the indicator (showing the price charged when the clock stops) and brought into operation by the stopping of the clock consisting in the combination of two oscillating bodies interconnected by a pin-and-slot device and a spring contact, and working differentially so long as the clock is in motion, an indicator free of the oscillating device so long as the clock goes, but electrically operated by the closing of circuit through the spring contact immediately upon the stoppage of the clock.

596,306. Dynamo-electric Machine. Pomeroy W. Power, Pittsfield, Mass. Application filed February 12, 1896.

The machine has a rotating inductor and laminated polar projections separately fastened to the inductor core by dovetail fastenings.

596,320. Printing Telegraph. Byron A. Brooks, Brooklyn, N. Y. Application filed August 11, 1894.

A line wire and electric switches connected in series in the line are employed, and means are provided for sending a characteristic succession of impulses over the line and through the switches successively, whereby a final impulse is transmitted directly to a magnet controlling the corresponding printing mechanism.



NO. 596,186.

596,356. Electric Call Box System. William T. Budds, Charleston, S. C. Application filed July 14, 1897.

An electric call-box is described, comprising a motor, a circuit-controlling wheel operated by the motor, a segmental block of insulating material on one side of the wheel, a metallic plate on the block and insulated from the body of the wheel, brushes normally resting on the plate and having connection with the line wires, and a ground wire having connection with the body portion of the wheel.

596,363. Quick-break Switch. Ralph C. Demary, Buffalo, N. Y. Application filed August 2, 1897.

Circuit terminals are mounted on a base; a switch-blade is pivotally secured to one of the terminals and co-operates with the other; a handle is pivoted to the first-named terminal and movable independently of the switch-blade; a spring connection is provided between the switch-blade and the handle; a swinging locking lever is pivotally secured to the base; a latch is secured to the switch-blade and insulated therefrom, the latch engaging with the locking-lever when the switch-blade is in its normal or closed position, and means are provided for disengaging the locking-lever from the latch when the tension of the spring is approximately at its maximum.

596,418. Magneto-electric Signaling Apparatus. Arthur S. Williams, Newton, Mass. Application filed June 5, 1897.

A key or press-button and a motor spring are adapted to successively move the armature in opposite directions respectively, and a detaining device controls and acts to delay the operation of the spring, and itself is controlled by the press-button.

596,439. Take-up for Controlling Slack of Trolley Ropes. Howard E. Adt, New Haven, Conn. Application filed May 10, 1897.

Claim is made for the combination with two spool-frame brackets permanently located upon the ends of a trolley car, of a two-armed spool-frame adapted to be detachably connected with either one of the brackets according to the direction in which the car is to be run, a non-rotatable spool-shaft mounted in the arms of the frame and formed with a longitudinal slot, a chambered spool mounted upon the shaft so as to rotate thereupon and adapted to have the lower end of a trolley rope attached to it, a spring located within the chamber of the spool and encircling the spool-shaft, a collar located in the inner end of the chamber, having the inner end of the spring connected with it and mounted upon the inner end of the shaft upon which it has lateral but not rotary movement, and a removable disk-shaped plate secured to the outer end of the spool, affording a bearing for the outer end of the shaft, and having the outer end of the spring connected with it.

596,456. Trolley for Electric Railway Cars. Edward Cone, Chicago, Ill. Application filed December 11, 1896.

A trolley pole is provided with a rotatable trolley wheel at the upper end thereof, guard mechanism pivotally mounted at each side of the trolley wheel and having substantially vertical and horizontal portions independently and pivotally mounted, means for normally holding such portions in their vertical and horizontal positions, and spring mechanism for keeping them in their closed position and permitting a separation of the parts when obstructions are met.

REISSUE

11,645. Signaling Circuit. Joseph J. O'Connell, Chicago, Ill. Application filed October 20, 1897. Original No. 555,707, dated March 3, 1896.

The first claim is given: The combination of an electric circuit with a key which, when manipulated, disconnects the normal terminal devices of the circuit conductors and connects one of the said conductors with a grounded call branch, including an electric generator and an electro-magnet, and at the same time connects the other side or conductor of the circuit with the ground; means for automatically locking the key when it is manipulated, means for automatically releasing it from a distance, and means associated with the said key also for manually releasing the same.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, JANUARY 15, 1898. No. 3

Electrical Plant in the Alexian Brothers' Hospital.

Plain and rather severe in exterior design, the large new building of the Alexian Brothers' Hospital at Racine and Belden avenues, Chicago, is nevertheless very completely fitted with all the requirements demanded by modern science to make a safe, cleanly and healthful home for the sick and injured. The building is pleasantly located and is surrounded by rather extensive grounds that are to be set out with trees, shrubbery, flowering plants and green sward, and which will in time form a pleasant retreat, with summer-houses and arbors, for convalescent patients during warm weather.

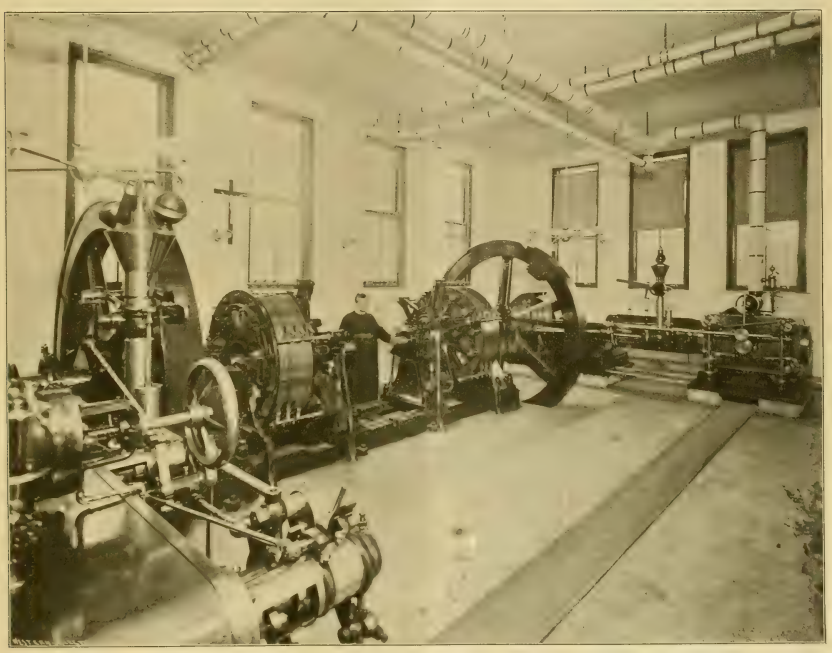
The exterior walls of the hospital are of pressed brick, and the building is substantially built about a central court. It is designed to be fireproof and to be in all ways practically adapted for the work in hand, without show. Wisely enough, the brothers in charge decided to spend their available funds in erecting as good a hospital as could be built for the money instead of lavishing it on architectural ornamentation. One noteworthy feature is the pains everywhere taken to insure absolute cleanliness. As far as possible all lodgments for dirt are obviated. There are no sharp angles to accumulate dust unseen; there is no material in floor or wall that cannot be easily and effectually cleaned. The hospital can accommodate 250 patients and is, of course, provided with all necessary departments—offices, waiting rooms, general wards, private rooms for patients, surgeons' operating rooms, nurses' quarters, kitchens and dining rooms, storerooms, morgue, etc. In addition, there is a pretty little chapel and a portion of the building styled the Brothers' House, where there are living accommodations for 60 of the lay brothers. At present the hospital shelters 40 brothers and four postulants, and Brother Aloysius, the provincial of the order, says that "they are all hard workers." A picture of the hospital is given on the next page. Richard E. Schmidt is the architect.

In this fine institution the mechanical and electrical plant has been carefully planned and is of unusual interest. The systems of heating, lighting, ventilation, power, communication and refrigeration are in each instance of a modern and improved type and thoroughly worked out. An intelligent and comprehensive use is made of electricity, and several views of the plant are given on this and succeeding pages.

Crude petroleum is burned as fuel under the boilers. The oil itself is not cheaper than coal, but it is well suited for use in an institution of this kind, as there is no dust, dirt or refuse in handling it. In addition, there is the advantage that no labor is required in the removal of ashes. The boiler room, illustrated on page 34, is a clean, light and airy apartment on the ground floor. It contains two water-tube Root boilers, made by the Abenroth & Root Manufacturing company of New York, each of a capacity of about 160 horse power. The boilers are equipped with Hoppes feed-water purifiers and rocking grates. The latter are so arranged that in case of an emergency the oil burners can be quickly pulled out and the boilers fired with coal, of which a small supply is carried. One boiler is ordinarily sufficient to carry the load; the the other is held in reserve. The Warren Webster vacuum system of heating by exhaust steam is employed. Atmospheric pressure is used, so that there is no back pressure on the engines.

Adjoining the boiler room is a well-arranged room for the pumps, feed-water heaters, oil tanks and other auxiliaries. The steam pumps are mostly of the Worthington type. This room is illustrated on page 35.

The generating plant shown by the picture on this page, is placed in a well-lighted corner room. It consist of two engine-dynamo units in duplicate. The engines are of the single-cylinder, slow-speed, horizontal, Corliss type, and operate at 90 revolutions per minute. At that speed, with one-fifth stroke cut-off and a steam pressure of 80 pounds they are rated at 65 horse power each. They were built by the Filer & Stowell company of Milwaukee. Directly coupled to the shaft of each engine is a Siemens & Halske multipolar, 120-volt compound wound, 60-kilowatt dynamo of the external commutator design familiar in larger power generators. These dynamos are driven at 90 revolutions per minute, of course, and are the first of this slow speed type built of this small size. They are guaranteed to have an efficiency of 93 per cent, and to run for two hours at an overload of 25 per cent. They rest on a planed rail runway in such a manner that the armature and commutator can easily be rolled to one side, exposing the field coils. The switchboard, when completed, will be of marble, and will have Hull switches and Weston instruments. It is designed by the superintendent.



ELECTRICAL PLANT IN THE ALEXIAN BROTHERS' HOSPITAL.—ENGINES AND DYNAMOS.

gineers, Pierce & Richardson, to have a double bus-bar system—one pair for light and one for power circuits. Thus, at periods of heavy load one generating unit can carry the lights and the other the motors—an arrangement of obvious advantage. However, a 600-ampere switch is provided to connect the two bus systems when desired, so that one or both units may carry the load. Each of the eight circuits leaving the board will be provided with a Cutter automatic circuit breaker.

All the wiring throughout the building is in iron conduits. The structure is divided into five sections for lighting, with a riser for each. One unusual feature of the wiring is the fact that each of these risers consists of the same sized cable from

ALEXIAN BROTHERS' HOSPITAL.

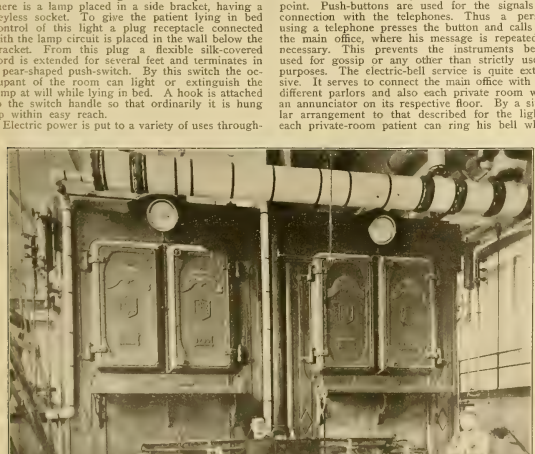
bottom to top, through the four stories. This method of distribution permits of very slight variation in voltage between the lamps on the ground level and those on the topmost floor. Each cut-out cabinet is provided with a double-pole switch for each circuit. The wiring system is planned for about 1,000 lamps of 16 candle power each. In the chapel a number of lamps are concealed behind stained glass windows and there is a 60-ampere dimmer to soften the light. In each private room there is a lamp placed in a side bracket, having a keyless socket. To give the patient lying in bed control of this light a plug receptacle connected with the lamp circuit is placed in the wall below the bracket. From this plug a flexible silk-covered cord is extended for several feet and terminates in a pear-shaped push-switch. By this switch the occupant of the room can light or extinguish the lamp at will while lying in bed. A hook is attached to the switch handle so that ordinarily it is hung up within easy reach.

Electric power is put to a variety of uses throughout the building. It is used to drive ventilating fans, to operate the refrigerating plant and to keep up a constant circulation of cold water and to drive elevators. For the first two mentioned four motors aggregating 36 h.p. power are installed in the attic, where they are belted to the fans which assist the circulation of air through the building. Three motors are also used in the refrigerating department. A picture of one is shown on page 35. This is a Holtzer-Cabot motor of about 20 horse power which drives a Linde ice machine made by the Fred W. Wolf company of Chicago. The picture shows the motor and its starting-box, the ice-machine and the gauge-board connected with the latter. In the same room a 1½ horse power motor drives a brine pump used in connection with the artificial-ice chamber, and another of the same size will operate a circulating pump which will keep the supply of drinking water for the hospital constantly cold by pumping it through a tank containing a coil of pipe filled with ammonia. The water for drinking is first sterilized by heating it to a temperature of 214°. It is then cooled to 34° in the tank mentioned and sent through the piping system, from which, at 16 taps in different parts of the building, pure, cold water can always be had for drinking.

The electric passenger elevator was installed by the Crane Elevator company. It has a capacity of lifting 2,500 pounds 150 feet a minute, and is operated on a separate circuit from the switchboard of the generating plant. The motor takes 130 amperes at 110 volts and is placed, with the operating mechanism, in the attic, at the top of the shaft. The elevator is equipped with all modern automatic safety appliances and is arranged to stop automatically at the first floor and the top floor. A patent flattened-strand Swedish iron hoisting rope, with hemp core, connects the car with the drum.

A dumb-waiter runs from the basement to the attic through a hatchway three by four feet, and is electrically operated also. A two horse power medium-speed motor in the attic supplies the power. By an ingenious combination of elevator controller and an automatic motor starter the outfit is so arranged that by giving a pull on the tiller rope the cage may be either started, stopped or the motion reversed. The car stops automatically at the top and bottom floors. All of the motors except that for the elevator were installed by E. R. Harding, who also put in the apparatus for controlling the movement of the dumb-waiter.

The means of inter-communication between different parts of the hospital include a speaking-tube system, electric-bell service and an equipment of 18 telephones. All of the telephones are connected with the main office, but are not arranged to be inter-connected by a switchboard at that point. Push-buttons are used for the signals in connection with the telephones. Thus a person using a telephone presses the button and calls up the main office, where his message is repeated if necessary. This prevents the instruments being used for gossip or any other than strictly useful purposes. The electric-bell service is quite extensive. It serves to connect the main office with the different parlors and also each private room with an annunciator on its respective floor. By a similar arrangement to that described for the lights, each private-room patient can ring his bell while lying in bed. The bell-pushes are also provided with hooks. They are distinguished from the switches for the lamps by a different colored cord.



ELECTRICAL TESTING IN THE ALEXIAN BROTHERS' HOSPITAL—BOILERS.

The Chicago City Council, on motion of Alderman Kahler, has passed an ordinance directing the mayor to appoint a committee to investigate the Garfield Electric Light company and see whether it has forfeited its franchise.

A Year's Electrical Exports.

The Treasury Department has completed the computation of the statistics covering the exports and imports during the last fiscal year. Hon. Worthington C. Ford, the head of the division which is entrusted with the preparation of these statistics, says that there is no branch of government statistics which more nearly affects, as well as interprets, the welfare of the American people, than this annual compilation on the commerce and navigation of the United States.

Mr. Ford declares that the exports of our manufactures have never been so large as they now are, and it is doubtful if they have ever increased so rapidly as they have in last few years. This has been accomplished in the face of the obstacles created by conditions of competition.

These statistics are interesting, because they show, the customs districts from which the articles were exported, the value of the exports from each district, the countries to which the exports went, and the volume and value of the goods sent to each foreign country.

The statistics which relate to the exports and imports of electrical apparatus constitute a highly interesting exhibit to the manufacturers and dealers in these lines.

EXPORTS OF ELECTRICAL APPARATUS.

From—	Values.
Baltimore, Md.	$ 4,713
Bangor, Me.	4,508
Boston and Charlestown, Mass.	57,411
New York, N. Y.	2,348,778
Passamaquoddy, Me.	87
Philadelphia, Pa.	5,944
St. Johns, Fla.	50
Corpus Christi, Tex.	79,173
Mobile, Ala.	14
New Orleans, La.	2,388
Paso del Norte, Tex.	37,604
Pensacola, Fla.	30
Saluria, Tex.	13,400
Arizona	7,935
Puget Sound, Wash.	71,120
San Diego, Cal.	290
San Francisco, Cal.	141,286
Buffalo Creek, N. Y.	23,082
Cape Vincent, N. Y.	1,347
Champlain, N. Y.	74,787
Detroit, Mich.	17,238
Genesee, N. Y.	32
Huron, Mich.	28,873
Montana and Idaho	24
North and South Dakota	15,277
Oswegatchie, N. Y.	39,040
Oswego, N. Y.	14
Superior, Mich.	1,708
Vermont	79,540
Total	$3,054,453

Sent to—	Values.
Austria-Hungary	$ 2,203
Belgium	168,864
Denmark	4,007
France	298,133
Germany	240,577
Italy	86,281
Netherlands	6,224
Portugal	3,405
Russia, Baltic and White Seas	33,445
Russia, Black Sea	4,223
Spain	2,188
Sweden and Norway	1,984
Switzerland	1,043
United Kingdom	437,085
Bermuda	2,436
British Honduras	330
Dominion of Canada:	
Nova Scotia, New Brunswick, etc.	22,242
Quebec, Ontario, etc.	261,104
British Columbia	21,317
Newfoundland and Labrador	5,926
Central American States:	
Costa Rica	12,550
Guatemala	43,703
Honduras	3,958
Nicaragua	7,529
Salvador	29,383
Mexico	284,714
West Indies:	
British	26,586
Danish	303
Dutch	6,359
French	804
Haiti	4,879
Santo Domingo	8,536
Spanish—Cuba	30,375
Puerto Rico	22,801
Argentina	157,564
Brazil	110,468
Chile	32,359
Colombia	66,084
Ecuador	7,559
Guianas—British	6,435
Dutch	12
Peru	14,650
Uruguay	2,721
Venezuela	80,226
Aden	20
China	5,813
East Indies—British	20,924
Dutch	212

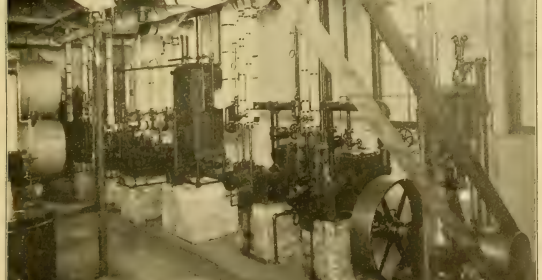
Hongkong	2,510
Japan	148,271
Turkey in Asia	263
All other Asia	1,559
Auckland, Fiji, etc	120
British Australasia	58,348
French Oceanica	14
Hawaiian Islands	53,512
Philippine Islands	3,054
British Africa	180,389
Canary Islands	121
Madagascar	25
Portuguese Africa	430
Turkey in Africa—Egypt	11,851
All other Africa	3,824
Total	$3,054,453

A Royal Electrician Coming.

The lady who chats about "Queer Sprigs of Gentility" in the Chicago Record over the signature of Marquise de Fontenoy, announces that King Humbert's only son, according to gossip among the Roman entourage of King Humbert and Queen Margherita, intends to visit the United States incognito early this spring, possibly a few weeks hence. The purpose of his crossing the Atlantic is not to become acquainted with the country, but merely to make a sort of pilgrimage to Menlo Park, and it is doubtful if he will go even to Washington. In fact, he is undertaking the journey to America with the sole object of visiting Edison at his home—that Edison for whom he has the most profound admiration, and who doubtless will be the recipient of the highest honors in the gift of the Italian crown when the prince comes to the throne.

Humbert's son and heir is passionately fond of electricity. He never has occupied himself much with art or literature, but he is a master of the science of electricity, and is acquainted with well-nigh everything that concerns its application to light, motive power, sound and photography. He was one of the first and most sucessful experimenters with the X-rays after their discovery, and his apartments in the Palazzino at Florence, which has been his home until now, bore the aspect of a scientific library. He may boast of being the one real practical electrician among all the royal personages of Europe. For, curiously enough, not one of them, with the exception of himself, seems ever to have devoted any attention to this branch of science, or to have made of it a hobby.

The prince will not impress people in the United States by the majesty of his appearance. He is very, very short, standing scarcely five feet in his boots. His face is the reverse of comely, and like all very small men, he has a keen sense of his own dignity, and endeavors to repress any tendency to



ELECTRICAL PLANT IN THE ALEXIAN BROTHERS' HOSPITAL.—PUMPS AND STEAM AUXILIARIES.

merriment due to his odd appearance by a particularly stern look and a very imperious manner. Indeed, there is no royal personage in Europe who is so very "stand off-ish" as the Prince of Naples, except when he happens to be with persons who possess the same eccentric traits as himself, when he loses all his self-consciousness and becomes the most charming and interesting of companions.

Northwestern Convention at Milwaukee on Wednesday, January 19th.

From present prospects the Northwestern Electrical association's convention at Milwaukee, beginning Wednesday next, bids fair to be one of the best, if not the best, in the history of the association.

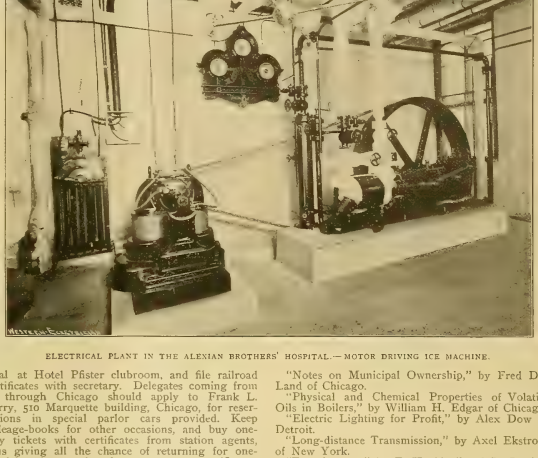
Secretary Mercein has issued the "last call" as follows: "Don't fail to be in Milwaukee on Wednesday morning, January 19th. Register on arrival at Hotel Pfister clubroom, and file railroad certificates with secretary. Delegates coming from or through Chicago should apply to Frank L. Perry, 510 Marquette building, Chicago, for reservations in special parlor cars provided. Keep mileage-books for other occasions, and buy one-way tickets with certificates from station agents, thus giving all the chance of returning for one-third fare, by securing the necessary 100 certificates. A large attendance is expected. The theater party will be on Wednesday evening, and the banquet on Thursday evening."

Arrangements have been made with the Chicago, Milwaukee and St. Paul Railway company to have special cars for the delegates, leaving Chicago at 8.30 a. m., from the Union depot, next Wednesday morning, January 19th, and it is hinted that there will be a special attractive feature on the train Chicago delegates and those intending to go to Milwaukee via Chicago will therefore undoubtedly prefer to go with the Chicago party on the Wednesday morning train. The fare to Milwaukee one way is $2.55.

The following list of papers has been prepared for the convention:

"Practice of Theory." by John C. McMynn of Chicago.

"Present Efficiency of Incandescent Lamps," by John E. Randall of St. Louis.



ELECTRICAL PLANT IN THE ALEXIAN BROTHERS' HOSPITAL.—MOTOR DRIVING ICE MACHINE.

"Notes on Municipal Ownership," by Fred DeLand of Chicago.

"Physical and Chemical Properties of Volatile Oils in Boilers," by William H. Edgar of Chicago.

"Electric Lighting for Profit," by Alex Dow of Detroit.

"Long-distance Transmission," by Axel Ekstrom of New York.

"Transformers," by E. H. Abadie of St. Louis.

Secretary Mercein also announces that he has received assurances from Prof. R. B. Owens of the State University of Nebraska that he will present a paper upon "Electricity in Municipal Engineering." This completes the list of contributions for that event.

The committee on entertainment, which is composed of James M. Hill of Chicago, W. L. Church of Milwaukee and Charles Cuno of Oconomowoc, has arranged a very attractive programme of social features. Mr. Mercein has been selected to preside at the banquet, which will be sufficient to assure the members of a highly entertaining evening.

Warping of the Eiffel Tower.

At a recent meeting of the French Academy of Sciences, says l'Energie Electrique, Col. Bassot read an interesting paper tending to establish the fact that the great French tower has a daily movement of considerable magnitude.

Col. Bassot explained, in effect, that the expansion of the metallic components of the structure produced a torsion movement from sunrise to sunset, which traversed a curve of 10 centimeters. This movement is repeated in an inverse direction during the night, as the column becomes cooled, so that the lightning rod on the summit of the tower is in constant motion.

Col. Laussedat, director of the Conservatory des Arts et Metiers, was appealed to for confirmation of Col. Bassot's statements.

"I have carefully followed the investigations of Col. Bassot," he said, "and the results given are perfectly exact. I cannot give the figures off-hand, but his work in this line is faithful and excellent, and extends over a period of 10 years of patient and interesting study. The laws of the expansion and contraction of iron by heat and cold are well known, and the tower simply obeys the physical law of temperature influence. In summer the expansion is superior to that in winter, and the movement reverses at night, owing to contraction, due to the cooling down of the iron. Yet, as Col. Bassot has stated, this twisting, this torsion, will in no case compromise the solidity of the structure, which is absolute. The constructors had, at the time of erection, all this in view, and calculated for it so that while the matter is one of interest, it is neither startling nor, from a methematical point of view, of serious importance.

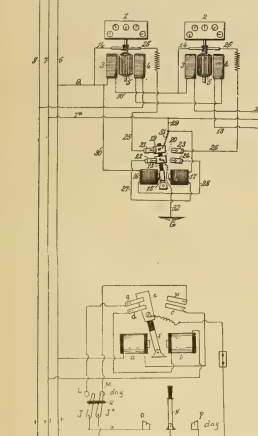
The Casselton, N. D., electric light plant is soon ready for operation

Multiple-rate Metering.

By Eustace Oxley.

Since completing the article relating to double-rate metering (published in the Western Electrician last week), the author's attention has been directed to inquiries concerning several points which it was thought unnecessary to consider in the space at his command. These questions relate, in part, to that form of the system in which a ground circuit is used, and as economic construction will award this form the preference, as it entirely dispenses with a separate metallic control circuit, and thus avoids the expense of tearing up pavements to lay it, it seems essential to point out the only difficulty that has been suggested to the writer, and to describe briefly the very simple means by which this difficulty, which has been anticipated, is entirely removed.

Wherever the ground circuit is used, it is evident that an accidental ground at any point upon the system may operate every controller, and, by prematurely throwing the armature bar over toward the magnet energized by the circuit that is closed through such an accidental ground, the meter registration at every point will, from that moment, be at the wrong rate. Unless this disturbance is corrected without delay, the results may be serious. If the ground occurs during the low-rate period the consumers are the sufferers, for



MULTIPLE-RATE METERING.

a comparatively short period might be enough, where current is used for power, to largely affect the monthly bills. But the generating company, while an involuntary gainer in a monetary sense, may lose even heavily in the diminished confidence of the consumer, and is fortunate if it escapes strong suspicion of having employed dishonest method.

To effectually guard against all objectionable results, possibly from such disturbances by automatically restoring the controllers to the condition that corresponds to the rate the meters are registering, when the ground occurs, a very simple apparatus is placed at the central office at any convenient point. It is shown in the accompanying diagram and consists of electromagnets a and b, the first terminal of the magnet a being connected to the positive side of the system and the second terminal carried to a clip c. The first terminal of the magnet b is connected to the neutral and to a clip d, lying opposite the clip c. Between these clips is a single knife e, carried by an insulated bar supported by the armature f. Upon the same axle with the bar f is a clip g, to which is attached a similar clip h, so arranged that, when thrown by the electro-magnets, the knife will enter both clips on the side to which it is thrown.

At a convenient point is a switch consisting of two arms, j, ja, pivoted at one end, and connected by a pivoted, insulating bar k. Thus, when moved in unison, one arm may be placed on a contact l, and the other removed from a contact m, or vice versa. The small, single-pole, double-throw switch, the arm n being preferably held by a spring out of its clips o and p, is the control which used at the central station. Its clips are connected to the positive and neutral by wires q and r respectively.

It will be noticed that the apparatus bears striking resemblance to the controllers. Its construction is varied but slightly, and there is no increased complication. The operation is as follows:

As shown in the diagram, the controllers have brought the day-rate into registration. This has been done by first moving the connected arms j ja, to the position shown, and then closing the arm n in the clip p. Upon releasing this arm it is thrown out of the clip, as shown, by a spring or other suitable device. This was completed by it has not only operated all the controllers on the system, but has also energized the magnet a and thrown the knife e into the clips g and d.

It will be seen that controllers were last operated from the neutral side of the system, and therefore, should a ground occur upon either the positive or negative, the magnet b will be energized, drawing the knife e out of the clips in which it lies and into the opposite clips. As it does so the positive is again grounded, and all the controllers are restored to their original position. As the ground is of short continuance, the knife e is automatically restored to the position shown in the diagram. As some of the controllers may be sluggish, it is well to retard the movements of this knife by a dash-pot, or other suitable means, to give time for the complete restoration of all.

An advantage is obtained by switching the controller-switches for 200 volts. Not only do they then require less current for their operation, but they are controlled from the central station by grounding either the negative or positive side of the system. A ground on the neutral, therefore, as it results in 100 volts only, does not affect the controllers, such a pressure being insufficient for their action. Thus, disturbances due to accidental grounds upon the neutral are excluded. Moreover, if a ground occurs on the side from which the controllers were last operated, no disturbance can result. The liability of such disturbances is thus greatly reduced. When they do occur, the results that follow will be instantly corrected, in the manner and by the means described.

Chicago Electrical Association.

The Chicago Electrical association held its first meeting of the year on Friday evening, January 7th, at 1737 Monadnock block. The paper of the evening was read by H. G. Dimmick of the Western Electric company, on "Electrical Shop Transmission." The writer, who has had considerable experience in the electric power transmission problem at the factory of the Western Electric company, treated this subject in a very practical way and made many suggestions which might prove of value to the practical engineer. He spoke of the importance of having a well-designed switchboard, so that any and all circuits are under the control of the man at the source of supply. He advocated the use of iron-armored conduit for running rubber-covered cable, and the use of iron pipes in which to run lead-covered cable. One great problem in electric shop transmission is the difficulty to get satisfactory automatic motor-starting boxes—boxes that are sure to open the circuit on the motor every time when trouble in the line. Most boxes, although they may operate very well when they are new, after having been used for a time, become gummy and stick, making them useless.

Mr. Hicks followed, and described the requirements of the modern motor used in shop transmission of power. The motor of to-day must be able to operate at variable speeds, and from a light load to a heavy load without sparking and without brush movement. It must also be dust-proof and so designed as to operate without much heating.

Mr. Sewell and Mr. Wiler took part in the discussion.

The association has bright prospects for the year. The membership is growing, and the work of the association is of constantly increasing importance. The new officers for the coming year are: President, C. S. Hickok; vice president, T. G. Grier; secretary, J. R. Cravath; treasurer, E. J. Swartout; directors, S. G. McMeen, J. M. Hallsted, and C. Wiler.

The next meeting of the association will be held on January 21st, when a paper will be read on "The Art of Constructing Telephone Apparatus," by H. P. Clausen of the Western Telephone Construction company.

The British Post Office, after a series of elaborate experiment, has at length adopted motor cars for use not only for the conveyance of letters, but also of parcels sent by mail in the metropolitan district, as well as in the principal cities of the United Kingdom. The innovation is pronounced a great success, and is giving much satisfaction.

Electric Switching Locomotive in Hoboken.

Latest among the heavy-duty railroads to adopt the electric switching locomotive is the Hoboken Railroad, Warehouse and Steamship Connecting company which operates the Hoboken Shore road in Hoboken, N. J. The line runs from Seventeenth street, Weehawken, to Fourth street, Hoboken, along the water front, or from the Erie tracks at Weehawken to the docks of the North German Lloyd Steamship company, Hobcken, a distance of about two miles. It was opened for traffic on September 20, 1897. It was constructed to provide connecting facilities between the tracks of the railroad companies entering Hoboken and the numerous warehouses and docks which line the west side of the North River from Hoboken to Weehawken. It is double-track over a private right-of-way from Seventeenth to Fourteenth street, single-track down Hudson street to Eleventh street and double-track along the river walk to Fourth street, Hoboken.

The switching of the cars for the last three months has been effected by a repair car of the Hudson County Electric Railroad company. The new locomotive was put into regular service on Tuesday of last week hauling trains of loaded and empty freight cars between the docks and the Erie track. The difference in its operation from that of the ordinary engine is immediately noticeable. The electric locomotive responds instantaneously to the movement of the controller handle and starts without jerk or noise, tightening up the couplings uniformly or coupling the cars together so gently that no blow is perceptible.

The locomotive (Fig. 1) was constructed in the shops of the General Electric company, at Schenectady, N. Y., and somewhat resembles in appearance the electric locomotive in use on the Manufacturers' railroad, which connects with the New York, New Haven and Hartford railroad tracks at New Haven, Conn., and the larger locomotives now handling the entire freight traffic of the Baltimore and Ohio railroad through the Belt Line tunnel at Baltimore. It is mounted on two four-wheel trucks, each axle carrying a "G E 2000" motor, giving the locomotive a total of 540 rated horse power. The weight on the drivers is 57,200 pounds; the drawbar pull is 10,000 pounds. The locomotive is driven through a single-reduction gear of very low ratio. The speed is correspondingly low, and is rated at eight miles an hour when hauling a heavy load.

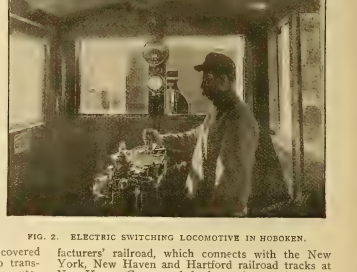


FIG. 2. ELECTRIC SWITCHING LOCOMOTIVE IN HOBOKEN.

At each end of the locomotive is an automatic coupler and a small railed platform for the brakeman in charge of the trolley pole. The car is of iron and resembles a double steam locomotive cab, with a sloping tender shield at each end. Drop windows are set around the four sides of the cab, affording an unobstructed view in all directions to the motorman. A sliding door on each side gives admission to the locomotive. The interior of the cab (Fig. 2) is lined with cherry and is a spacious and well-lighted room. The fittings are all of polished brass or nickel. On each shield is a headlight; in addition one shield carries a bell, the other a chime whistle. Beneath one of the shields are four packed-card resistances, two sand boxes, the compressed-air tank and the equalizing-air tank; beneath the other eight resistances, two sand boxes and the engineer's tool box. At one end of the cab is placed a controller of the series-parallel type known as the L 2, arranged to operate the motors either four in series or each two in series-multiple. Beside the controller is the air-brake handle and the two valves of the sanding arrangement by means of which the sand is blown by the compressed air under the wheels.

In front of the motorman is an air-brake gauge and above it an ammeter reading to 500 amperes. Fastened to the roof of the cab is an automatic circuit breaker set at 500 amperes. On the other side of the controller from the motorman is another circuit breaker and an automatic governor

switch for the air pump, placed at the other end of the cab. This is a single-cylinder pump driven by a three horse power iron-clad bipolar slow-speed motor. The operation of this air pump is automatic. When the air in the tanks is at normal pressure the governor switch is opened. Blowing the whistle, applying the brakes or using the sander causes the pressure to fall. This closes the switch automatically and starts the motor and pump. The cab is lighted by five standard Edison railway incandescent lamps.

The dimensions of the Hoboken locomotive are: Length over all, 29 feet; width, eight feet; height over trolley stand, 13 feet; wheel-base, five feet six inches; truck centers, 12 feet 9 inches; weight, 57,000 pounds.

The No. 00 overhead wire is suspended from wires strung between octagonal cedar poles, except at two or three points, where bracket construction is used. When the locomotive turns in from Hudson avenue to the River Walk, a peculiar condition has caused a special method of bracket construction. It was necessary for the overhead line to be so set as not to infringe upon the limit of the next property. Thus at this point the overhead line is suspended from two bracket arms, one six feet and the other 18 feet long. The current for the road is taken from the station of the Hudson Electric Light company.

The trial trip of the Hoboken electric locomotive as witnessed by representatives of all the railroads having offices or termini in New York and New Jersey. The locomotive was coupled to eight loaded freight cars with an aggregate dead weight of 295⅝ tons. It handled this train with ease. It was then coupled to a number of passenger coaches and the party made the journey over the line from Hoboken to Weehawken and back.

At the luncheon which followed, two interesting

a pace on acceleration that would not have been dreamed of two years ago, and the schedule which he has mapped out for the contemplated electrical equipment of the suburban lines of his company involves a rate up to 40 miles per hour in 20 seconds. That this is practical has already been demonstrated. In fact so high a rate of acceleration has been made as 43½ miles per hour in 20 seconds, so that the practicability of Mr. Lundie's plans have been thoroughly demonstrated. This for passenger service.

"In another direction even greater changes may be prophesied as coming from the adoption of electricity in standard railroading; that is, the lengthening of freight trains and the consequent reduction in that most important feature of operating expense, transportation wages. The advantages of electricity will have so thoroughly demonstrated themselves in the directions suggested that instead of main steam lines with electric feeders, in 10 years it will be a question of electrically operated main lines with steam feeders through the sparsely settled districts, and a more extended system of suburban and interurban electric roads in densely populated districts also feeding the main lines.

"The electrical engineer has much to learn from the steam-railroad man and must constantly rely upon him for suggestions as to the best methods of making practical applications of electricity. The American transportation man and the American electrical engineer should go on hand in hand, continuing to lead the world as they do now in all transportation problems. The American engineer has won conquests abroad as well as at home. Not the least is the solution of the problem of electrical equipment for the Central London Underground railway, the most important of this character that has yet been accomplished. The American engineering plans were selected on account of their

FIG. 1. ELECTRIC SWITCHING LOCOMOTIVE IN HOBOKEN.

speeches were made. Mr. F. Le Bau, general freight agent of the West Shore railroad, pointed out emphatically the usefulness of such a road as the Hoboken Shore Road in facilitating the transport of merchandise directly from the steamships to any part of the country, and of the rapid-switching electric locomotive, by means of which the freight cars could be handled more easily and more expeditiously than with the ordinary steam-drill engine. Mr. W. J. Clark, general manager of the railway department of the General Electric company, in an interesting talk full of reminiscences of the early days of the street-railway struggle, said:

"Ten years ago the development of three things made electric street railways practicable and profitable. These were the underrunning trolley, the carbon brush and the modern method of motor suspension. The development of three other things now renders the general application of electricity to standard railroads both possible and probable. These are the safe breaking of heavy currents, high voltage for their transmission and methods for their application to almost any load on any portion of a line. Other features are being developed that will seriously affect the result; not the least is the Sprague system of multiple and unit control, increasing the flexibility of the already most elastic of all transportation agents, and while the economy of electricity has already been thoroughly demonstrated in performing the same service as by steam or animal traction, so far as passenger service at least is concerned, something beyond the mere question of economy has now to be considered; to wit, accomplishment by electrical methods of what would be entirely impossible with steam. The first steam railway man within my range of acquaintance to fully grasp this idea is Mr. John Lundie, consulting engineer for the Illinois Central Railroad company, who has set

merit, in the face of the severest competition from every European electrical manufacturing company, and no greater tribute can be paid to American engineering methods than to state that 80 per cent. of all the electrical railway apparatus used in Europe is designed in America so that the American engineer stands to-day head and shoulders above those of any other country. With the encouragement of the co-operation of American railroad men he is bound to revolutionize the entire method of transportation within a comparatively short space of time, so that American railroad methods will then, as now, be in advance of those existing anywhere else on the face of the earth."

The Electric Light in Port Arthur.

This is the way the Port Arthur (Ont.) Herald speaks of that town's electric light system: "The General Electric company sold the town a lighting system, and installed it in May last. The old thing worked fairly well for several months, and then came a burnout and the town was in darkness for a night. Superintendent McCauley repaired the damage to the armature, and away went the thing spinning at the rate of a good many hundred revolutions to the minute. And so it spun for a comparatively few nights, when a second burnout occurred—in a new place. Once more the damage was repaired, and away went the machine for a short time, when a third burnout happened. Three burnouts in 40 days rather dazed the management and they telegraphed the company at Toronto a gigantic kick. An expert was immediately sent. He arrived, looked over the machine, shook his head and went for a new armature said something about crystallized wires, nodded his head sagely, said it was all right and took train for home."

A Great Light.

[From the New York Sun.]

"The lightning light," the huge bivalve lens which was exhibited at the World's Fair by Henry Lepaute of Paris, France, and was purchased for $10,000 by the Lighthouse Board and has since been on exhibition at the expositions at Atlanta and Nashville, is now [December 28th] undergoing a 10 days' test at the general depot of the lighthouse establishment at Tompkinsville, S. I. If this exhaustive test is successful, the light will probably be installed at some point along the coast, though its exact location has not yet been decided upon.

The lenses of this light are nine feet in diameter. Each is composed of a central disk, two prismatic rims, and 190 prismatic segments of rims, all of carefully ground optical glass. The prisms of each lens are mounted in a brass framework made in 19 sections. The light is furnished by a specially designed electric arc, and there are three lamps. Two of them are interchangeable by simply turning a hand-wheel, and the third can easily be substituted for either.

The lamps have interchangeable carbons of different sizes, so that the light can be varied in intensity, according to the condition of the atmosphere. With carbons one inch in diameter, the light is equal to from 8,000 to 10,000 standard candles. Each lens gathers nearly a half of this light and projects it in a beam nine feet in diameter, which has an estimated intensity of 90,000,000 candles. Such a light on a lighthouse high enough could be seen 100 miles away, and in actual use it can be located at a still greater distance by its reflection on the clouds. The light and lenses revolve six times a minute, so that a beam from one of the lenses is flashed in a given direction once every five seconds. The lamp, the lenses, and the supporting framework weigh 20 tons. They are supported by a hollow steel cylinder floating in mercury, and so slight is the friction that one may revolve the whole mass by pushing with a finger. The regular revolving mechanism is a clockwork driven by a falling weight of 100 pounds.

The lamps have an automatic feed, which keeps the arc in the focal center of the two lenses. The current to run one is of 55 volts, and its amperage varies from 25 to 100, according as carbons of one-half or 1½ half inches in diameter are used. The French generator and engine made for the outfit were not purchased, as domestic machines were thought to be as well fitted for the work. Two General Electric alternating generators, driven by a 25 horse power Ideal engine, and Fitzgibbons boilers will constitute the plant. Everything is in duplicate in case of a possible accident.

Access to the space between the lenses is by iron steps at one side of the heavy pedestal of the light. At the head of these steps is a grating which, when opened to allow one to ascend, automatically stops the revolution of the light. The lenses are over four feet apart at the center and one standing in the space between them, which from inside, has the appearance of being completely surrounded by solid glass, is dazzled by the brilliance of the light they transmit from the outside. At night, and with the light burning, the effect is far more bewildering. From without one cannot look at the flash of the lenses at short range. It hurts the eyes, even when closed. A captain in the lighthouse service says he can read a newspaper at Ridgewood by the light from Staten Island.

The tests are being conducted under the supervision of Lieut.-Col. D. P. Heap, corps of engineers, U. S. A., engineer of the Third Lighthouse district, and C. A. Lamy, superintendent of the depot. One criticism so far made is on the use of mercury for the bearing. There are on the floor above the big light two smaller ones mounted in mercury, and the other on a ball bearing, designed by Lieut.-Col. Heap, and while the one in mercury, though it weighs only 300 pounds, moves no more easily than the 21 ton below, a mere breath will revolve the one on ball bearings.

Big Subway Project in Chicago.

The Chicago Underground Subway company is an applicant for a franchise permitting it to construct subways under all the streets and alleys in the central district, bounded by Division street on the north, the lake and Michigan avenue on the east, Twenty second street on the south, and Ashland avenue on the west. George W. Jackson, formerly of the contracting firm of Wilson & Jackson, is the president, and John Phelan of Baltimore, Md., is one of the heavily interested men in the new company. The company claims to have a financial backing of $5,000,000, and the compensation it offers the city is the free right to use the subway for city water mains, fire-alarm, telegraph and police telephone and electric wires.

As introduced, the ordinance provides for the granting of a 50-year franchise to construct subways and place within them pneumatic tubes, telephone wires and cables, telegraph wires and cables, electric wires, gas and water mains and "such other things as the company may deem advisable to accept." The subway may be 18 feet [illegible]. The ordinance was sent to the committee on [illegible] and electric light, of which Alderman Mulcahy is chairman.

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State of Illinois, County of Cook—ss:

Thomas Jansen, being duly sworn, deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the foreman of the printing department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the printing of No. 21 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were printed by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified. And further this affiant saveth not.

THOMAS JANSEN.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES, Notary Public.

Four Years' Record of Electric Light Convention Advertising.

Issue	Number of Advertising Pages.	Whole Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894	40	56	4,145
February 23, 1895	52	68	5,593
May 9, 1896	72	88	7,576
June 12, 1897	80	100	8,643

No other electrical journal has ever equaled this record of 8,643 square inches of genuine full-paid advertising in a single issue.

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Judging by the list of papers and authors announced for the meeting of the Northwestern Electrical association at Milwaukee next week, and given on another page, the convention will be well worth attending. And it is becoming evident that the gathering will be a large one, with good prospects for sustained interest. The winter conventions of this organization are its annual meetings, when the officers are elected and when the element of recreation, although not forgotten, is naturally less conspicuous than at the summer pilgrimages. This year, when everybody is feeling the influence of improved business conditions, the members have a right to look forward to the most successful meeting in their history.

M. Anderson, the Icelandic scientist, who has labored so long and earnestly to accomplish the installation of an electric cable from Europe to the frozen island of the north, seems in a fair way to accomplish his purpose. The project is not new, but has been allowed to slumber so long that it has really been forgotten until quite recently. A company has been formed and the Icelandic Parliament has been asked for assistance. Twenty years ago 35,000 crowns was voted for this purpose. The Danish government has also promised to assist, so that the outlook is favorable for the establishment of telegraphic communication during 1898.

The route adopted is from the north of Scotland to Thorshaven, the chief town of the Faroe Islands, 250 miles distant, the greatest depth of the sea being 408 meters, with a bed composed of mud and broken shells. From Thorshaven to Bernfiord is 240 miles more, and the mean depth of the water is 550 meters, save at one point, where it attains 1,250 meters. The bottom is of sand, broken shells mud and in two places of broken pumice stone. From this landing point the line will be carried to Reikaivik, the capital, either by land or along the south coast. This latter portion will measure 200 to 300 miles, depending on the route.

Some of the figures presented in Mr. A. S. Hibbard's recent article in the Western Electrician on "The Telephone in 1897" are really remarkable. He shows that in Chicago, where the number of daily calls is greater than in any other exchange in the world and where an average of 3½ miles of wire is used for each connection, the total extent of wire connected up daily for telephonic conversation is 770,000 miles. The figure gives an idea of the extent to which the telephone enters into modern life. The central exchanges of New York and Chicago serve, in round numbers, 20,000 and 15,000 telephones, respectively, and there are thousands of instruments in the two cities that are not included in this enumeration. Mr. Hibbard says that probably 100,000,000 telephonic conversations are held yearly in the United States. And it is probable that the number will increase for several years to come, as the tendency now is to make the use of the telephone cheaper and more popular. Many of the trunk-line railroad men are now complaining that the use of the long-distance telephone is affecting their passenger receipts, and it is not impossible that the coming telephone extension in cities may have some similar effect on street-railway traffic.

It is a fact of much significance that at the St. Paul live-stock convention this week Mr. F. J. Berry, the well-known horse dealer of Chicago, took occasion to publicly deny, as the newspapers put it, "that there was any danger of electricity taking the place of the horse. Export demand for horses had doubled in 1895," he said, "and again in 1896. In 1897 this country exported 50,000 horses, the greater number of them sold on the Chicago market."

By this denial we presume that Mr. Berry means that horse breeders and dealers need have no fear from electrically propelled vehicles, which are now coming into prominence. Perhaps he is right, and undoubtedly the horse—the saddle horse in particular—will always be a familiar domestic animal, never without loyal admirers. Possibly, too, practice will show that the field for horseless carriages and wagons is a more limited one than is anticipated. And, again, it may prove in this as in older phases of industrial development, that while the horse is displaced in one avenue of human endeavor he will come into increased prominence in another. But the important fact remains, and that is that this late mechanical application to vehicular traffic has assumed such importance in the eyes of a practical man whose interests are involved that he has taken occasion to declare in public assembly that the horse is in no danger of disappearing from among us. It is certainly a declaration of considerable significance.

In the report of the case of Charles Thorpe, who sued the corporation of Dublin (Ireland) for injuries sustained by receiving an electric shock in the street, recovering $100, we find some interesting and amusing testimony. On the evening of October 30th, it seems, the plaintiff was standing close to one of the electric lamps at the corner of Nassau street and Grafton street, when he suddenly received a shock which threw him prostrate upon the ground, inflicting injuries which, it is claimed, rendered it necessary that he should temporarily abandon his employment and place himself under medical care. He testified that when he stepped on an iron plate in the ground he received a "terrific shock." He said he felt as if he was struck by hundreds of needles, and when he opened his mouth (for what purpose is not stated) he could not shut it, and he "was made to dance about." The judge remarked that the public ought to take notice of this dancing-board. The witness, continuing, said that he had never been the same since the accident and that he had been out of work since that time. His work, it transpired, was that of a clerk to a betting-man, for which he received $30 a week. The doctors appeared to have disagreed, as usual, over the case, for one at the hospital told Thorpe that he "ought to get cash out of this," while another, sent by the corporation, "jeered at the case and seemed to take the view of the electrical engineer more than anything else." The accident occurred on Saturday night, but on Monday the injured man was looking for a lawyer and the prospective cash. There was some question, at the trial, of the sobriety of some of the witnesses on the evening of the occurrence, and one man, William Darling, declared that it was an impudent falsehood for anyone to suggest that he appeared to have taken a drink. He was a perfectly sober man, he said, and on that day he had only taken three glasses of porter after three o'clock. The most damaging bit of evidence against the defense was the admission of the superintendent of the electric light system that on the night in question the insulation did give way on some of the underground cables and the current was then shut off.

The lawyer for the city thought that even if the plaintiff had received injuries they were of the most trifling character, but the recorder thought that it was a serious case. The report of a portion of his honor's finding is worth quoting from the report: The electric system in Dublin, although good, was not by any means perfect, as they all knew. He, therefore, held that sufficient control was not exercised, and he was confirmed in that by the fact that the corporation was applying for the means of an improved supply or system. It was astonishing how in courts they heard people swearing other people out of their senses. There was not a shadow of a doubt on the evidence that this thing took place. The action and conduct of the plaintiff throughout proved that he was not intriguing or malingering or attempting deception. This young man at the corner of Nassau street, and two others, strangers apparently to each other, met, and the plaintiff stood upon this iron plate and was turned almost into a Christmas harlequin—that he felt something like the pricking of needles. It was a mercy that he was not killed. It was dramatically one of the most remarkable incidents that had occurred in the city. He was told that what had been deposed to was impossible to have occurred. He did not care a fig for what scientists might say in view of proved and certain facts. He did not, however, believe that the plaintiff was much injured. He believed that he received a shock, followed by nervous excitement. In conclusion, he considered that the plaintiff would be fairly treated if he made a decree for £20 and £3 3s. for the attendance of Dr. Fegan. At this point the doctor spoke up and said that he had attended his patient eight times, so the judge made the decree £25 altogether.

Reports of Chicago Electric Railway Companies.

The annual meetings of several of the street-railway companies of Chicago were held during the week. At that of the

West Chicago Street Railroad Company

Mr. Yerkes stated his belief that there was no end to the life of the franchises of the company. "We realize," said he, "it is now proper for the West Chicago road to pay the city a fair share of its profits. But the excessive amounts suggested by ignorant people are not worth talking about. No improvement of this road has been made without great opposition, and not one but has been a great blessing to the city. We have done for the city infinitely more than it has done for us."

President Yerkes' report to the stockholders was as follows:

"Since our last report there have been a number of changes made in the condition of our affairs, and we find the reverse as far as our business is concerned, to what it was the year previous. That is to say, in the year 1896 the fore part of the year was good, while the latter part was bad. In 1897 the fore part was bad, while the latter was good.

"For eight months during last year there was a decrease in receipts, and for four months there was an increase. I am pleased to say, however, that the decrease was more than met by the decrease in expenses.

"The decrease for the first eight months amounted to $194,122.18, and the increase during the last four months amounted to $68,838.87, making a total decrease in receipts of $125,283.13 and a decrease in expenses of $208,704.07.

"The total amount of receipts for the year 1897 was $3,899,918.19. The operating expenses were $1,929,664.48, leaving a profit from operating of $1,970,253.71, against $1,880,569.90 for the previous year.

"The interest charges, insurance and taxes amounted to $399,719.79, against $280,906.68 for the previous year, which left a balance of $1,570,533.92, from which we deduct fixed charges amounting to $736,465.00, which leaves a balance applicable to dividends of $834,068.92, against 864,455.72, being at the rate of 6.32 per cent. interest on the capital stock.

"Notwithstanding the decrease in expenses, I can safely say that the road was never in such good condition as it is at the present time. The tracks have been kept in excellent order and the rolling stock greatly improved, and this result certainly reflects much credit upon the general manager, Mr. Roach, and his superintendent, Mr. Yuille.

"During the year $10,000,000 consolidated five per cent. bonds were issued. $4,000,000 of these bonds were deposited with a trust company to take the place of the $4,000,000 first mortgage bonds when those bonds become due. The balance were used to retire the debenture bonds and to pay off the floating debt, which had been incurred by changing from horse to electric power. The latter weighed most heavily upon this company during the critical financial days of 1896, and the fact that it is removed is a subject of congratulation to the stockholders.

"As you will notice by the statement given you in the fore part of this report, the street railroad companies did not really feel the effect of the improvement in business until the month of September. Every month from the 1st of January showed a decided loss, when suddenly in that month a change took place, which has continued ever since.

"It was expected that the opening of the loop would have an effect upon the business of this company, but strange to say, notwithstanding the fact that the loop commenced business the fore part of October, the increase in receipts for October over the same month last year was over $22,000.

"There is no doubt in my mind that it does have some effect on our company, but the truth is, that better facilities induce travel, and while it is possible that our increase since the loop commenced running would have been greater, yet, it is certain that the opening of the loop has produced an increase in travel.

"As I said to you last year, the prospect for the future depended entirely on the general business of the country, which at that time did not look very bright, so that prospects for this year depend on the same cause, but the reverse this year is the case, because there never was a brighter outlook for the business interests of this country than at the present time."

The report of the treasurer showed the following comparison of financial condition with that of 1896: Gross earnings, $3,899,918, decrease, $119,030; operating expenses, $1,929,664, decrease, $208,714; profits from operation, $1,970,253, increase, $89,683; fixed charges, including taxes, interest, rental of leased land, $1,136,184, increase, $120,070; applicable to dividends, $834,068, decrease, $30,386; dividends paid, $791,340, same as 1896; income account, $42,728, decrease $30,386; percentage earned on capital stock, 6.32; 1896, 6.55.

The following named directors were re-elected: Charles T. Yerkes, William L. Elkins, P. A. B. Widener, Harvey T. Weeks, S. W. Rawson, F. H. Winston and J. M. Roach.

North Chicago Street Railroad Company

Mr. Yerkes told the stockholders of this company that there was no street railroad in the world "in a finer condition as regards tracks, depots, power houses, rolling stock and everything pertaining to the operating department;" and the president is convinced that the North Side system, "has attained the perfection that we have been working to accomplish." The cost of the experimental Connolly gas motors has been charged to profit and loss. The treasurer's report was as follows:

Capital 1896, $6,600,000; 1897, $6,600,000.

Receipts.

	1896.	1897.
Passengers	$2,826,800.65	$2,818,398.90
Other sources	86,909 81	93,153.51
	$2,913,710.46	$2,911,552 41
Operating expenses	1,394,387.93	1,319,926.63
Net earnings	$1,519,322.53	$1,591,625.78
Charges: Including railway rental, taxes, interest, insurance and loss on World's Fair stock and Connolly motors	524,231.40	636,462.73
Net on stock	$ 995,091.13	$ 955,163.05
Regular dividends paid	758,901.00	791,943.00
Balance	$ 236,190.13	$ 163,220 05
Percentage earned on stock	15.07	14.47
Percentage operating expenses	49 32	46.83
Passengers carried	56,523,620	56,354,147
Miles run	10,590,036	10,644,270
Passengers per mile	5.3	....
Receipts per mile	26.5	....

Receipts.

	1896.	1897.
Cable lines	$1,535,311 05	$1,421,848.78
Electric lines	1,192,601.85	1,375,638.57
Horse lines	98,887 75	20,911 55
Total receipts	$2,826,800.65	$2,818,398.90
Percentage of operating expenses:		
Cable	45 17	47.67
Electric	51.22	44.92
Horse	90.98	115.26
Cost per car-mile:		
Cable	13.00	13 40
Electric	12.50	11.40
Horse	22.10	20.60

Directors were elected as follows: Charles T. Yerkes, W. F. Furbeck, F. H. Winston, J. Charles Moore and Benjamin B. Lamb, the last-named succeeding Hugh McBirney.

Lake Street Elevated Railroad Company.

The report of this company was disappointing, and the stock sold down from 16½ to 13 on the strength of it, although there was afterward some recovery. President Louderback, in his report, said:

"Considering the fact that for the first six months of the year we had business depression in all parts of the city and the country at large our results may be considered satisfactory.

Gross earnings (increase $6,292.05)		$579,960.73
Operating expenses (decrease $10,258.90)		339,124.21
Net earnings (increase $16,550)		$230,636.19
Fixed charges:		
Interest (miscellaneous)	$ 29,673 58	
Taxes	16,618.90	
Coupon interest, nonassenting bonds	32,810.00	
Coupon interest, debentures	194,795.00	
Loop rentals	15 707.20	
Total		$291,789.66
Deficit for year		40,962.19
Extraordinary expenses for improvements, which might properly be charged to construction account, but are charged to expenses, amount to		31 680.17
Making the total deficit		$ 72,642 36

"In the deficit of $40,962.19 there is included the 40 per cent. paid by order of court on 175 nonassenting bonds, amounting to $8,750, which, if deducted, would leave the actual deficit $32,212 19.

"It is the policy of the company to charge into expense account everything which can properly be placed there.

"During the year the company received valuable franchises in the town of Cicero by the terms of which it is privileged to build an extension of one mile of elevated structure in Lake street and surface feeder lines in the remainder of the territory covered by the ordinance.

"We have also during the last year made connections with the Suburban Electric Railroad company at Fifty-second street and Robinson avenue, which will in time become a very valuable feeder, tapping as it does a number of the growing towns west and southwest of our terminus.

"We have now under consideration additional franchises in the territory west of Fifty-second street, which will benefit that entire section and build it up very rapidly, and at the same time add largely to the revenue of this company.

"October 1st the loop was completed and opened for traffic, and, while these additional terminal facilities did not enable us to derive as great benefits as accrued to the other elevated roads, our receipts were materially increased.

"The business of the company is increasing and there is no doubt that this year we will reap substantial benefits from the improvements recently made and the connection arranged for."

The road carries about 30,000 passengers daily.

Columbia Construction Company

This is the company organized to build the Northwestern elevated railroad. The annual report showed that during the year the only construction work done has been in the erection of the iron which was then on the ground, being 4,409 feet of four-track structure from Dayton street to Fullerton avenue, and 2,400 feet from Grace street to a point just north of Buena Park station, making a total distance of 1.3 miles during 1897, and up to date 3.2 miles of four-track structure. The manufactured metal will cover 80 per cent. of the entire length of the road. Fifty-one per cent. of the entire length of the structure has been erected, and 10 per cent. of the maufactured metal which has not been erected is now distributed along the right-of-way between Belden and Fullerton avenues.

Mr. Louderback, the president of the company, concludes his report as follows: "Everything pertaining to the construction of the Northwestern elevated railroad is in first-class condition to push the road to a speedy completion as soon as satisfactory financial arrangements can be made. Several attempts have been made to finance the road during the last year, but owing to financial stringency in the beginning of the year, and various complications since, it has been impossible to do so up to the present time. We have expended on account of real estate, construction, interest and due bills issued to subscribers the sum of $6,290,611.53. We estimate it will require to complete the road the further sum of $2,712,737, and to pay off its obligations (after realizing on its assets) and to complete the road, the total sum of $3,500,000. That something must be done there is no doubt, as the structure already erected is gradually going to decay. This company has been overcome by the unfortunate conditions which have prevailed in finances almost ever since the construction was commenced, and it seems as though, if an arrangement could be made by which the Northwestern company could finish the road, it would be well to do so, and thereby relieve the construction company."

By a resolution offered by B. E. Sunny, the Columbia stockholders voted to surrender their contract, leaving to the Northwestern company the work of completing the structure. Failure to secure funds is given as the cause for this action. Mr. Yerkes stated that the Northwestern company would be able to negotiate a sale of $4,000,000 of its bonds if it could act directly, and intimated that a price of 90 could be obtained from an eastern syndicate, the proceeds at that price being $3,600,000, which covers the $3,500,000 necessary to complete the road.

Calumet Electric Street Railway Company.

The Calumet electric railway of Chicago has the unusual distinction of being operated by the receiver of a national bank. It was practically owned by the National Bank of Illinois at the time of the failure of that institution, and is now operated for the benefit of the creditors of the bank. John C. McKeon, the former receiver of both institutions, has just made his report. He says that the average monthly earnings show an increase of 20 per cent. over the earnings of the road for the corresponding months of the previous year. He regards the property as a valuable asset of the National Bank of Illinois, and thinks the traffic figures indicate that the road can be sold in a year or two for sufficient to cover the $2,575,000 advanced to it by the bank.

The report shows that for the seven months of last year that the receiver had charge of the road its earnings were $144,995.17, and the operating expenses, including maintenance, were $121,025.30, giving a gain of $23,969.87 over expenses. During the year $72,037.98 was expended for construction, $20,134 77 of old claims were paid by order of court, and a loan of $38,500 from the National Bank of Illinois was repaid.

The balance sheet accompanying the report is as follows:

Cash on hand April 30, 1897	$ 511 65
Passenger receipts	141,136 09
Miscellaneous receipts	3,859 08
Sale of receiver's certificates	144,703 20
Accrued interest of same	1,363 13
Total receipts	$291,603.15

The expenses were:

Operation	$121,025 30
Construction	72,037 98
Interest on receiver's certificates	525 83
American Casualty Insurance company	1,101 46
Settlement of prior litigation (accidents)	2,916 61
Approved claims per order of court	20,134 [illegible]
Cash advances	38,500 00
Bills payable	22,509 41
Interest	1,891 18
Due from city of Chicago	11 35
Total expenditures	$281,[illegible]
Less decrease in stores and vouchers approved and unpaid	[illegible] 42
	$[illegible]
Cash on hand and in Pullman Loan and Savings Bank	$[illegible]

The road has 68 miles of track south of Sixty-third street, with lines running to South Chicago, Roby, Kensington, Pullman, West Pullman and intermediate territory.

Chicago General Railway Company

At the annual meeting of the stockholders of the Chicago General Railway company Glenn E. Plumb was elected director in place of L. F. McGann, resigned. The full board is now as follows: J. P. Black, John H. Witbeck, C. L. Bonney, Lyman M. Paine, Glenn E. Plumb, L. C. Bonney and S. D. Lawton. The officers are President John H. Wit-

beck; vice-president, C. L. Bonney; secretary and treasurer, L. C. Bonney.

The operating statement of the West and South Towns Street Railway company from January 1 to July 31, 1897, shows a deficit of $17,226. On August 1st the property was taken over by the Chicago General company, and from that date to December 31st, operating 13½ miles of single track, the latter company showed a gain in receipts over disbursements amounting to $18,376. The net result for the whole year was as follows:

Receipts.

From passengers	$78,699.40	
Miscellaneous	1,121.83	
		$79,821.23
Disbursements.		
Maintenance	$ 5,474.71	
Transportation	29,411.23	
General expenses and taxes	7,632.82	
		$42,518.76
Fixed charges		36,155.00
Total		$78,671.76
Gain		1,149.47

Gas Has Its Place.

[From the New York Sun.]

Everyone must recognize the beauty and many advantages possessed by the electric light, but perhaps few have thought of the discomforts to which a large part of the population would be put if this most modern and perfect illuminant were to supersede all the older forms in use.

An excellent example of this is to be found in the large workroom of the reporters in The Sun office. In the room are scores of incandescent electric lamps, and no gas jacks for light, but at an odd corner there is also a burning one little gas jet, whose light is insignificant, but dearer to the men who work about it than all the electric lights in the room. Day and night, year in and year out, this gas jet burns with a flame not more than half an inch high, and a quarter of an inch broad, and day and night it is the Mecca of every man who resorts to tobacco smoking to soothe his nerves or kill idle moments. Everybody knows where to find a light for cigar, pipe or cigarette, but the way not true years ago when the electric lights took the place of the old gas jets which lit the room. With these open lights in profusion no one had ever found it necessary to keep a stock of matches at hand for starting a smoke. For many a day and night after the electric lights were established there were great hunts through the office for matches, and often finally it became the fixed custom to have a light going at a corner near the parting desk to accommodate the smokers.

Receipts of the Citizens' Traction company of Oshkosh, Wis., for 173 days' operation amount to $17,777. The company's one-half per cent. tax amounts to $265.55.

Montauk Multiphase Fire and Burglar Cable.

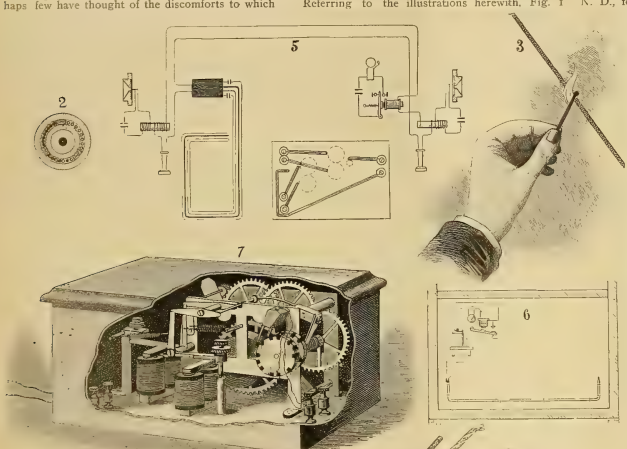
The Mntauk Multiphase Cable company of 100 Broadway, New York city, has recently placed on the market an electric cable, which promises to be of great value in many directions. The officers of the company are: President, John D. Gould; vice-president, C. W. Price; secretary and treasurer, Charles A. Hanson. These gentlemen, with Horace D. Brockway, form the executive committee of the company. Mr. Price, the vice-president, is a well-known electrician, and was formerly superintendent of the Baltimore and Ohio Telegraph company, and was later connected with the Westinghouse interests.

The manufacturers of the Montauk multiphase cable state that it is not a competitor of any electrical interest, but it is designed as an auxiliary to all systems of fire and burglar protection now in use. The principal difference is that every part of the cable is alive to the approach of dangerous heat or flame and is capable of giving an automatic warning at any desired point. The breaking of the cable will perform the same service. The use of this cable to connect thermostats and other heat-detecting devices as well as burglar-alarms is said to insure a perfection of protection heretofore unknown.

Referring to the illustrations herewith, Fig. 1 shows the cable, which is stranded on an inner copper wire coated with a metal that fuses at the low temperature of 374 degrees. It is stated that the fusible metal alone would carry the necessary current, but the copper is increased to increase the conductivity. A suitable insulation is braided on the fusible metal coating, and over this is stranded a series of smaller wires, separated with insulations, as shown in the illustration. The cable is now covered with an outer protective wrapping. One of the outer wires may form a fire-alarm circuit, another a burglar-alarm circuit, another may be added for a servant's call, and still others may be used for a number of electrical purposes. Fig. 2 shows a cross-section of the cable. In Fig. 3 is illustrated the fact that the cable may be fused with a lighted match. Fig. 4 shows the cable surrounded by a conduit for use on ships. A wiring diagram for a house fire alarm system connected with the central fire station is shown in Fig. 5. Fig. 6 illustrates the method of wiring a room for fire alarm. When the circuit is automatically closed by an outbreak of fire the current operates the magnets in the controller, shown in Fig. 7, which act upon a system of levers and release a clock mechanism. The arms to rotate two controlling disks, which by means of make-and-break contacts ring up the call corresponding to the location of the fire and show the corresponding number on the annunciator. The disks are so arranged that they repeat the alarm at the central fire station.

The Montauk multiphase cable forms an effective burglar alarm, for if a burglar should attempt to cut the cable the pliers will form a metallic connection between the inner and outer wires of the cable and close the circuit, thus giving an alarm. To avoid any error in connecting up the return wires, they are made in different colors. The fire-alarm wires are of copper, another set are copper wires tinned, and a third set may consist of alternate tinned and copper wires. To reduce the bulk, each set consists of several fine wires whose aggregate cross-section is sufficient to make up the required conductivity. In view of the many purposes for which this cable is designed, its bulk is extremely small, in fact small enough to be installed without attracting unusual attention.

Where this cable is used on shipboard, such as for detecting fire in coal bunkers, it is laid in a conduit which protects it from rough usage, and at the same time leaves it exposed to the action of the heat. The Montauk Multiphase Cable company owns a number of patents covering this cable, and states that it is a manufacturer only, and does not contract or install systems.



MONTAUK MULTIPHASE FIRE AND BURGLAR CABLE.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The City Council has been petitioned in Fargo, N. D., for relief from poor telephone service furnished by the Northwestern Telephone Exchange company. Dr. Hill was appointed a committee of one to lay the complaint before the officials of the company in Minneapolis.

G. Taylor Wright has a project for a telephone exchange at Humeston, Ia.

The Wisconsin Telephone company will shortly give Waupaca, Wis., all-night service. The telephone system will be used for fire alarms altogether hereafter.

The Wisconsin Valley Telephone company has arranged to connect its long-distance system with the Luce-Vietch exchange at Galesville, Wis.

The Wisconsin Telephone company has won the first round of the fight between the city of Sheboygan, Wis., and itself. The friends of the company have succeeded in having the council refer the proposal of General Bragg to take the case against the company, to a committee. A report is not looked for from the committee very soon, and the time is drawing near when the company will have obtained a right to occupy the streets by adverse possession.

The Marquette County Telephone company has declared a dividend of $10 per share. The company has been organized but three years, and has been operating its system but two. In view of the opposition from the Bell company this showing is gratifying.

The result of advancing telephone rates in Oshkosh, Wis., by the Wisconsin Telephone company has resulted in 40 instruments being ordered out. The company has had its rates below that of the Northwestern Telephone company for a year, and on January 1st it advanced them to the same as the home company's. The Wisconsin company has about 500 subscribers and the home company 531.

The Eau Claire Telephone company's exchange is being installed in Eau Claire, Wis., as rapidly as possible. Toll-line connection over the Wisconsin Valley Telephone company lines will give connection with 120 towns. A large number of them are already connected and the remainder will be soon.

The Electric City Telephone company has opened its exchange for business at Great Falls, Mont. The company is a home institution and cooperative to a certain extent.

Several Minneapolis aldermen have gone to Willmar, Minn., to examine the Western Electric Telephone company's instruments in use there. They go on the invitation of that company, which is seeking an entrance to Minneapolis. A number of business men from outside towns have petitioned the Minneapolis Council to give them connection with this city over the Western Electric company's wires.

A practical test of the long-distance telephone was made last week. Charles J. Glidden, president of the Traders' National Bank of Lowell, Mass., was in Minneapolis, and by means of the American Telephone and Telegraph company's wires, presided over the regular meeting of the bank directors, held in Lowell. Mr. Glidden called the meeting to order and easily recognized each member as he spoke into the instrument 1,500 miles away.

The Northwestern Telephone Exchange company has paid the state treasurer of Minnesota $10,024, being the three per cent. on its gross earnings for 1897 business.

Because the Chicago Daily News, on December 31st, printed an article bitterly arraigning the projectors of the Northwestern elevated railroad in Chicago, under the title "Northwestern Elevated Bandits," the company has brought suit to recover $300,000 for damages for the libel alleged

Farr Telephone and Construction Supply Company in Its New Home.

In the accompanying illustration (Fig. 1) is shown an interior view of the office and salesroom of the Farr Telephone and Construction Supply company, now located in new and commodious quarters in the Ellsworth building, 357 Dearborn street, Chicago. The success of this company has been so marked that a brief sketch of its career will be of interest.

The Farr Telephone and Construction Supply company was founded February 1, 1895, locating at 342 Dearborn street, Chicago, and was incor-

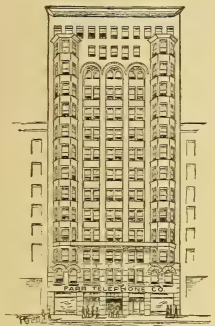


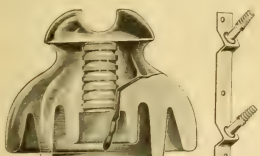
FIG. 2. FARR TELEPHONE AND CONSTRUCTION SUPPLY COMPANY IN ITS NEW HOME

porated under the laws of the state of Illinois March 30, 1896 with a capital stock of $10,000. By honesty and fair dealing its trade has increased with rapid strides. Its business during the last year amounted to over $50,000. The success of the company is attributed to the principles it adopted when starting into business, namely, to make every customer satisfied even if a sacrifice must be made to do so. This method has secured for it a large number of steady customers extending from California to Prince Edward's Island and many foreign countries.

The head of the firm, C. W. Farr, is a thorough telephone man, having been associated with the Bell Telephone company for 12 years. On January 1st the company took up new quarters in the 14-story Ellsworth building, an exterior view of which is shown in Fig. 2, facing Dearborn street and Plymouth place. The offices and show store are on the ground floor of 357 Dearborn street, and the electric assembling room and shipping department are at 88 and 90 Plymouth place. The officers of the company are: President, C. W. Farr; N. O. Farr, vice-president; secretary and treasurer, R. J. Cram (of Detroit, Mich.); general manager, E. W. Hurst.

Locke Insulating Devices.

The cuts show two of the insulating specialties that have made the name of Fred M. Locke of Victor, N. Y., famous. Fig. 1 represents Mr. Locke's patent triple-petticoat glass insulator for



FIGS. 1 AND 2. LOCKE INSULATING DEVICES

potentials up to 20,000 volts. This insulator is 5½ inches in diameter and 4½ inches high. It will carry with satisfaction any current up to 20,000 volts. The manufacturer supplied in December over 30,000 of these insulators, carrying potential up to 17,500 volts.

The two-pin upright galvanized side bracket is shown in Fig. 2. This device is used for attaching high-capacity insulators to the sides of buildings and other similar places. These brackets are made in several convenient sizes.

Technical Projects Before Congress.

A bill is before the House of Representatives to establish engineering experimental stations in connection with the colleges established throughout the United States, where investigations and research may be carried on relative to the principles and applications of the various branches of the science of engineering and of naval architecture; to aid the Navy Department in its researches, to enlist the co-operation of builders, manufacturers, and establishments in the prosecution of such experimental work as will secure to the naval service the best material, the highest type of motive power and other machinery and accessories for warships and other naval vessels; to aid states and territories in the experimental determination of the composition and value of their minerals, fuels, constructive materials, and other resources, as well as the scientific and economic questions involved in the utilization of raw materials and the development of water, steam and electric power in the production of manufacturing products, and to this end it is asked that an appropriate amount be set aside from year to year by the government for the furtherance of such an idea.

Representative Bennet has introduced a bill to provide for a contract between the government and the Pacific Cable company of New York, whereby for the sum of $125,000 per year, payable quarterly, for 20 years, official communication may be maintained between the United States and Honolulu in the Hawaiian Islands, either by means of electrical or other methods, through a submarine cable of cables and connecting land lines; also to Japan and Australia.

A bill is before the Senate looking to the extension of the track of the Capital Traction company of Washington from its present line at Eighth and Pennsylvania avenue S. E., to the Avenue bridge, this extension to be completed within one year.

Another bill, introduced by Representative Curtis of Iowa, provides for an amalgamation between the Eckington and Soldiers' Home Railway company, the Maryland and Washington company and the Belt Line, whereby a means of electrical transportation may be opened up between Washington and Laurel, Md. The bill also provides that the name of the Eckington company shall be changed to that of the "City and Suburban Railway company."

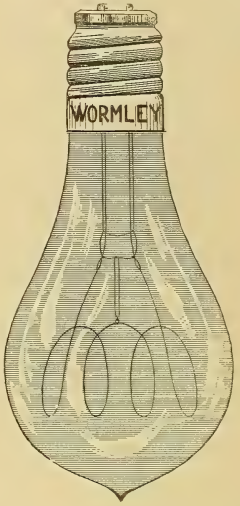
It is proposed to regulate the charges for telephone service in the District of Columbia by means of Congressional regulations, which would place a charge of $25 per annum for telephones in private houses, $35 for those in business or commercial houses, and $50 per annum for all telephones placed in hotels. The bill carries with it a provision for a fine of $250 for each and every contract that should be made for charges in excess of the amounts named above.

The Capital Traction company is seeking a further amendment to its charter by means of which it may extend its underground system from its present terminus on U street, so as to make a loop line near the northeastern section of the city.

Nicholas Bink has been granted an electric light franchise in Chilton, Wis.

The Wormley Lamp.

The accompanying cut illustrates one of five new styles of incandescent lamps just placed on the market by James C. Wormley & Co. of 1242 Marquette building, Chicago. These lamps, together



THE WORMLEY LAMP.

with about 60 other lamps, all of different styles, will be on exhibition at the Northwestern Electrical convention in Milwaukee, January 19th.

The new 220-volt Wormley lamp is claimed to be

FIG. 1. FARR TELEPHONE AND CONSTRUCTION SUPPLY COMPANY IN ITS NEW HOME

of an efficiency of three watts per candle power. James C. Wormley & Co. state that at a test just completed, lamps of this efficiency showed an average life of nearly 1,000 hours, which is a remarkable showing for 220-volt, three-watt lamps. The Farr is also making a specialty of 50-watt 110-volt power lamps in regular voltages, and has many good reports of their work from well-known consumers.

The Wormley lamps are manufactured exclusively by the Shelby Electric company of Shelby, O., under contract which permits Wormley & Co. to

inspector in the factory, who personally tests all lamps before accepting them from the factory. This protection permits Wormley & Co. to guarantee each individual lamp as perfect and to make additional guarantee that all shipments will be "perfectly satisfactory in every respect." The firm pays freight both ways on trial orders, if goods are not found as represented. It also sells the regular Shelby "tipless bulb" lamps. It has branch offices at 207 Newspaper Row, St. Paul, Minn., and 600 Burlington building, St. Louis, Mo.

CORRESPONDENCE.

New York Notes.

New York, January 11.—It has been reported that Tammany intends to introduce a bill at Albany to legislate the Rapid Transit Commission out of office, but the rumor is not generally credited. H. H. Vreeland, president of the Metropolitan Street Railway company, when asked what influence any organized opposition by Tammany to the underground road would have upon his company, said that if his engineers decided that the plans were practicable his company would bid for the contract despite any change in the political complexion of the commission. He doubted, however, if any such thing was contemplated.

Rapid progress has been made in the equipment of Metropolitan lines with the trolley conduit system. Cars have been operated with this system in Fourth and Madison avenues for about two months, coming as far down-town as Astor place, and by the end of the month it is expected that the electric cars will be running all the way to the postoffice. They will then come into fair competition with the cable cars in Broadway and Third avenue. In the meantime, the work of installing this same system on several other lines of the Metropolitan company is in progress. In addition to the Madison and Fourth avenue line, the longitudinal lines to be equipped with the underground trolley are those in Second, Sixth and Eighth avenues, and work has also been under way for some time in Twenty-third and Fifty-ninth streets. When all these roads are "electrified," about 60 of the 228 miles of railroad under the control of the Metropolitan company will be equipped with mechanical power—that is, either electricity or cable. In building the Fourth avenue line some unexpectedly serious obstacles were encountered in pipes of all kinds that had either to be moved to one side or sunk deeper in the earth to make room for the heavy yokes, which go down in the ground more than two feet and a half. At Fourth avenue and Twenty-third street, for instance, according to the Tribune's account, the underground conductors that had to be dealt with included one two-inch Edison pipe, two 2½-inch Edison pipes, one three-inch Manhattan light pipe, 10 three-inch electric subway pipes, two four-inch Western Union pipes, one four-inch gaspipe, seven six-inch gaspipes, two eight-inch gaspipes, one 10 inch gaspipe, one 12 inch gaspipe and one large trunk line sewer pipe. In spite of these things, rapid progress was made on the section between Astor place and Forty-second street. Traffic was stopped here on August 31st. Within an hour hundreds of men and teams were busy along the line, and in 24 working days this part of the road was completed so that horse cars were running over it again on September 30th. This section, of course, included the tunnel, about half a mile long, where everything had to be carried in and out at the ends. On the lower part of the line, where it runs through the Bowery, Grand, Broome and Center streets and along Park Row, special difficulties have been met with on account of the other railroads that have to be crossed, a number of curves and the putting in of a cross-over at the terminal by the postoffice. Nevertheless, it is expected that all the work will be finished and the electric cars in operation by or before the beginning of February. It is said that the cars on the East Side electric line travel at a faster rate of speed than is permitted on any other surface road in the city. In the tunnel between Thirty-third and Forty-second streets the motormen do not have to look out for vehicles and pedestrians, and stops for passengers are [illegible] consequently they turn the current on full [illegible] and run along at the rate of 15 or 20 miles an hour.

There is a good deal of [illegible] conjecture on the effect of electrolysis from the return current of the electric railway system on the Brooklyn Bridge, but only a few [illegible] that the [illegible] will be [illegible] in a few weeks. It is expected that within two or three weeks the [illegible] trolley cars [illegible] end of the bridge.

The new subway for telephone and telegraph wires under the Harlem River has just been finished. It is of Georgia pine, bound with iron hoops, and is two feet in diameter. It is laid [illegible] eight feet below the surface at [illegible] new Third avenue bridge. The wires [illegible] be drawn through the subway [illegible] the bottom of the river where they [illegible] exposed to disturbance.

Samuel Booth, an electrician [illegible] Abraham & Straus, died suddenly [illegible] while working on the electrical apparatus [illegible] employer's store. It was at first supposed that he died from an electric shock, but it was afterward said that he died from natural causes. Booth was 40 years old, and had worked for Abraham & Straus for three years. He was busy rearranging the brushes in the big dynamos under the center of the store, when he was seen to throw up his hands suddenly and fall over. A surgeon was sent for, but Booth died before assistance could be had.

Interest in the electrical show to be held in Madison Square Garden in May is in increasing. Everybody remembers the success of the show of 1896. Then it was held in a building comparatively unknown for such a purpose, yet it attracted not only the trade but great throngs of people from the territory within 100 miles of New York. The exhibitors themselves were well paid in business for the cost of their respective exhibits, and the best evidence of this fact is in the early demand from former exhibitors for increased allotments of space. Contracts are already in for more than one-half of the total space sold in 1896. When it is remembered that the exhibition is four months away and that at the last show, as usual in such shows, more space was sold just before the opening of the show than in the several months before, it will be readily seen that the latecomers may be losers. When the management took a lease of Madison Square Garden, it was thought to be a rather bold step. As the plans are now developing, it is evident that so big a building is absolutely necessary. The advantages of location and building and the increase both in variety and number of exhibits will certainly attract a large attendance. There were over 300,000 admissions in 1896. There was only one battery of boilers in operation in the 1896 exhibition. From the arrangements already made, there will be at least three in the Madison Square Garden show. The engine and dynamo exhibits will exceed those of the last show, it is said, by about three to one. All these things suggest to the intending exhibitor the importance of speed in securing space. While the garden is larger than the last exhibition building, the demand for space is greater in proportion than the increase of space. It is believed that the illustration of the various apparatus and supplies will be complete, varied and interesting, and public interest in these things will no doubt lead the newspapers to give the show a great deal of notice. It seems proper to say a word about the generating exhibit. In the old building, with a smaller and less interesting plant and only one entrance by an obscure stairway from the main hall, it proved to be a feature of public as well as trade interest. Enough interested people found their way into it to make it profitable to the exhibitors. In Madison Square Garden this feature will be larger, more varied, more interesting and more accessible. There will be at least four entrances from the three sides of the building, and the skill and care in placing the exhibits, pointing out the features and properly advertising them, which made the last operative exhibit successful, ought to make this one still more successful.

When Mayor Van Wyck suggested improved facilities for handling the "L" service of this city and intimated that electric motors should take the place of steam locomotives Russell Sage in an interview practically told the new mayor to mind his own business. Now, it seems, however, that the "old man" made a mistake, for George Gould has announced his intention of complying with the mayor's views and Russell Sage has been relegated to the rear. It is estimated that the new electrical plant will be the largest in the country, and although it is too early to make any reliable figures it is believed that a central station of 75,000 horse power capacity will be erected.

W. F. O.

New England News.

Boston, January 11.—It is reported that President Clark of the New York, New Haven and Hartford railroad and his associates are considering the advisability of constructing a third-rail electric system between Boston and Providence, a distance of about 50 miles, to be operated over the rails of the present steam line. Those who are exploiting this scheme argue that President Clark has shown on his Hartford and New Britain branch that frequent service and low fares mean a tremendous increase in business, amounting, in the case of this short line, to over 300 per cent. per day, it is said. If the time ever comes when the company can see its way clear to unite the capital city of Rhode Island and Boston with a third rail line, there is no question as to the effect it would have in stimulating traffic, not only between the terminal points, but between intermediate stations, as thousands of people would, if the rates were put down to a street car basis, make frequent visits to relatives and friends in other towns, while thousands would ride simply for the pleasure of the thing. President Clark has shown by the advanced step he has taken in the field of electrical traction that he is a thorough believer in its applicability to steam roads, and it is to his enterprise and far sightedness that the New England communities are indebted for the benefits they now enjoy as a result of the wider use of electricity in heavy railroad work.

A plan for the consolidation of nearly all the electric light and power plants in Portland, Deering and Westbrook, Me., is under consideration. The Indurated Fiber company of Lockport, N. Y., which controls extensive water privileges on the Presumpscot River at North Gorham, Me., endeavored to secure from the Legislature a permit to furnish electricity for Portland, but the Consolidated Electric Light company, which holds an exclusive privilege in Portland, fought and succeeded in defeating the petition. Thereupon the other company granted an option on its water privilege to several capitalists, who organized the Sebago Electric Power company and bought up the rights of the old Portland Electric Light company, which had some years ago ceased to do business. These rights were supposed to include authority to do business in Portland, but that claim is denied, and it is said that it will be vigorously contested by the company now in possession of the Portland field. According to the best information, the Sebago Electric Power company has made a proposition to supply power to the several electric light companies that are supplying Portland, Deering and Westbrook, the Portland and Yarmouth electric street railway, the Warren Manufacturing company of Cumberland Mills and the Portland and Cape Elizabeth railway. The various corporations are considering the proposition, and are said to look favorably upon it. The new project contemplates the building of a series of dams on the Presumpscot River at North Gorham and the erection of a large power house at Rockameecook Falls.

A main steam pipe exploded at the Albany street power house of the West End recently, but by a fortunate combination of circumstances no one was killed or seriously injured. The pipe which burst was one which ran from the main power station into the old building in which the original electric plant of the West End company, operated by high-speed engines, is located. This old plant is used as an auxiliary one, and is operated perhaps not more than once a month, when power is needed. The break occurred in a joint of the main pipe, and with its force blew off a portion of the roof of the building and broke the windows in the place and in adjoining buildings. It had been the intention of the company to put in a new pipe or discontinue the use of the old plant.

It is said that negotiations are pending which will result in the purchase of the Newburyport, Amesbury and Plum Island electric railroad by the Lowell, Lawrence and Haverhill Railroad company. This will give the last named road complete control of all the electric railroads between Lowell and the ocean.

The Boston Electric Light company has purchased the entire property known as the Harrison Loring property, situated on the water front on East First street, South Boston. There are more than 16 acres of solid lands and flats in the premises, besides the buildings. The total water frontage is about 500 feet, extending out to the reserved channel. This valuable property is below all bridges and has advantages of deep water, making it a much-desired location for the company to build a plant as large as all its stations combined, with plenty of room for expansion. The valuation of the property is about $97,000.

The lease of the West End Street Railway company to the Boston Elevated Railway company has created some inquiry as to just what has taken place in the process of consolidation and of the nature of the relationship that these interests bear one to the other. So far as the work of amalgamation has gone, no real change has taken place in the financial department of the West End. The receipts, of course, are now turned over to the treasurer of the new company, and the disbursements also are directed from his office. Practical men will be required at the head of the several divisions, and these in turn must be under the immediate supervision of someone having a thorough knowledge of the operating department, and it may be that many of the old and tried officials of the company will be retained in their present positions. It is gossiped that the $7,500 annually set aside under the West End lease for maintenance of the West End organization will be expended as follows: For president, $3,000; treasurer, $2,500; vice-president and clerk, $1,500; directors, $500. Gen. William A. Bancroft assumes the direction of the practical operation of the street-car interests which have been leased to the Boston Elevated Railway company. This change, according to existing arrangements, marks the cessation of the West End as an operating company for 25 years and perhaps forever. The West End will maintain an organization somewhat different from its past organization, but that organization is not yet determined upon.

The railroad committee of the Boston Board of Aldermen has made a favorable report on the petition of E. Moody Boynton, for a location for his elevated bicycle railroad in the streets of Boston. Mr. Boynton has been before different legislative bodies in Massachusetts for years trying to get a charter under which he could operate his road. The Legislature of 1897 gave him a charter to build from Fall River to Boston, paralleling the lines of the New York, New Haven and Hartford to Boston, but the location stopped at the boundary of the city. Now Mr. Boynton wants a charter so that he can take his passengers right "downtown."

Work upon the construction of the new storage building to be erected in this city, Fabin and Canton streets, by the Edison Electric Illuminating company, has again begun and the foundations are nearly completed. The structure will be built of brick and stone, and will have a frontage each on

Canton and Fabin streets of 30 feet, extending from one street to the other. It will be two stories high and 90 feet long, built in the most substantial manner and fireproof throughout.

Mr. John W. Gibboney, private secretary to Professor Elihu Thomson of the General Electric company, a position which he had held for several years, died in Lynn on December 27th. He was a talented inventor, not only in electrical matters, but in other fields of mechanical development. He made a series of elaborate inventions in relation to the use of the electrical current in telephone work. Mr. Gibboney had also made valuable inventions in the way of windmill improvements and the storage of electricity by means of wind power. Another line of his inventions was in the attainment of greater efficiency of water heating by means of gas. He was born in Pennsylvania 40 years ago and leaves a widow and two children. C. S. G.

Northwestern Notations.

Minneapolis, January 11.—Mr. Thompson, who is putting in an electric light plant at Dawson, Minn., finds the demand for lights so much greater than he expected that he will put in a larger plant than was at first intended.

The Lanesboro, Minn., electric light plant was attached recently for between $600 and $700, claimed to be due Ed. Lynch for wages.

The Western Union Telegraph company is arranging to extend its wires north from Seattle, Wash., to Victoria. The line will be in operation in a few weeks.

Fred Donaldson's grain elevator in Yankton, S. D., is operated by electricity generated by an artesian well.

The Citizens' Electric company of Lewistown, Mont., has been organized and $4,200 worth of stock subscribed. The present company's service is very unsatisfactory and this step is being taken to get better light.

The Gisholt Machine company of Madison, Wis., which operates a plant to furnish light for its own factory, has applied for a franchise to furnish commercial lighting.

The council of Council Bluffs, Ia., has granted a franchise for an electric car line to the Council Bluffs, Lake Manawa and East Omaha Construction company.

The street railway system of St. Cloud, Minn., will be sold January 27th. The amount due on bonds and interest is $187,272. The company has just received six new motors, the old ones being worn out.

J. K. Tillotson of the Citizens' Traction company of Oshkosh, Wis., says he has practically concluded arrangements for an electric line to Neenah, and that it has no connection with the Appleton-Neenah line now being constructed.

The electric light plant at Bedford, Ia., is about completed.

Louis Christiansen secured a verdict against the Winona Street Railway and Light company, in Winona, Minn., for $2,000 damages for the loss of his minor son's leg.

F. H. Josslyn sues George H. Ketcham in Oshkosh, Wis., to recover $2,256.98 for services rendered in promoting an electric street railway in the city of Oshkosh.

Charles H. Baker of Seattle, Wash., has bought Snoqualmie Falls, near that city, and will develop electric power and transmit it to Tacoma, 30 miles, and Seattle, 29 miles. The minimum power expected in the dry season is 32,000 horse power and the average for 10 months of the year is expected to be about 50,000.

Electric lighting is being talked of in Mandan, N. D.

J. G. Harschberger has been granted a 10-year franchise for electric lighting in Lancaster, Wis.

The Centerville, Iowa, Electric company has been incorporated to put in an electric light plant and has applied to the council for a franchise.

Gouldberg & Anderson of Cambridge, Minn., have been granted a franchise for an electric light plant. The Northwestern Electric company of St. Paul is putting in the plant.

The council of Grand Forks, N. D., has added $15,000 to the annual appropriation to purchase an electric light plant. Injunction proceedings will be begun, it is said, as soon as an attempt is made to enter into a contract.

Stephen Bull has established an electric plant in Racine, Wis., at a cost of $7,000, to furnish light for several residences.

The Superior Rapid Transit company of West Superior, Wis., will hereafter carry mail to the outlying districts.

The American Signal and Power company, of which Henry B. Higgins is president, has completed the test of an invention for igniting gas and gasoline engines by electricity. Heretofore, it is claimed, the machines of this kind have worked all right as long as there was no variation in speed, but when this occurred, the generators were thrown out of circuit. The device is so constructed that when an unexpected load is added, or from any cause the speed varies from the normal, the generator cuts itself out and the battery furnishes current for the electric spark.

W. J. Bonwell of St. Paul has installed two 30-kilowatt generators at Spring Valley, Minn., for the Electric Light and Investment company's sub-station. For five years a plant with a capacity of 500 incandescents was sufficient, but the growth of the place has necessitated this enlargement, which gives about 1,100 lights.

The Electric Machinery company of Minneapolis is engaged in remodeling and enlarging the electric lighting plant in the North Side pumping station of the city. A new switchboard will be put in place and some radical changes introduced. This company is also making two 20-kilowatt generators for the Gillett-Herzog company, three 10-kilowatt generators to operate the elevators in the new Andrews building and a five-kilowatt generator for furnishing light in the Swinburn flats.

The Twin City Electric works has lately installed a small dynamo and engine in the Guaranty Loan building, to provide light when the large dynamos are shut down.

Judge Johnson has dissolved the Gladstone Electric Light company, in accordance with a petition from the incorporators. J. W. Kendrick, John Woods, Ruth Tice, Edwin S. Tice and P. H. Relf were the stockholders, and the headquarters were in Minneapolis.

The St. Paul council and the Twin City Rapid Transit company have not yet reached an agreement. A new ordinance has been proposed providing for changing the Selby avenue cable line into an electric and giving it a limited franchise. Several other changes are made in the Albrecht ordinance which has caused so much discussion, the principal alterations being in regard to transfer privileges and a reservation of the right to abandon the line on Prior avenue to University.

The St. Paul Street Railway company is considering the extension of the Rice and Concord Street electric line to South St. Paul, thus affording excellent facilities to the employes of the Swift Packing company in that district.

The Swedish-American bank, at the corner of Washington and First avenues south, this city, has installed electric apparatus for the purpose of protecting the vaults. The steel safe is lined with oak and four thicknesses of tinfoil and insulated paper. If the lining is touched even so much as by a needle point it breaks the electric circuit, and a large gong fastened on the outside of the building is sounded. The alarm can be heard for blocks. The Electric Protective company put in the apparatus.

Judge Canty of the Supreme Court has given a decision in the case of Joseph Frein, respondent, against the St. Paul City Railway company, reversing the decision of the trial court. The judge holds that when a pedestrian is crossing the street he is guilty of contributory negligence unless he keeps his eyes open for approaching street cars. The application of the street-car company for a new trial is granted.

The electric plant and flour mill at Janesville, Minn., has been compelled to close down, owing to a shortage of water. The town will probably be in darkness all winter.

The municipal electric light plant at Moorhead, Minn., has a balance of $3,728.79 to its credit at the end of 11 months' operation. The council has reduced rates for lighting from $1.50 to $1 for all night and from 75 to 63 cents for 12 o'clock.

Business men of Lyons, Iowa, have formed a stock company to put in an electric light plant. A system to cost about $10,000 is proposed.

The council of Tacoma, Wash., contemplates purchasing new electric light machinery for the city plant.

Christian Burkhardt has leased the electric light plant at Hudson, Wis., to Christian Wangsgard. Mr. Burkhardt plans to operate the plant from the big dam four miles out of the city, with the opening of spring. A new power house is to be erected and other changes made at a cost of several thousand dollars.

C. K. Mead of Des Moines, Ia., says he will sue the General Electric company for $866, which he claims is due him on account of expenditures in attempting to defeat the munici[illegible]l electric lighting proposition last spring. He claims he spent $1,000 which was paid him, and also $866 which was not, and for this he sues. It is not claimed that the money was spent illegitimately.

The Electrical Workers' union of Minneapolis has elected the following-named officers for 1898: President, O. R. Shortall; vice-president, J. M. Rush; recording secretary, W. S. Haywood; financial secretary, J. L. Wolfe; press secretary, W. F. Carpenter; treasurer, J. J. Summers; foreman, J. H. McCarty; trustees, F. R. Wright, G. F. Kelly, John Supple.

The City Council of Waupaca, Wis., has granted a franchise to Paul H. Sanborn and Robert D. Wynn for an electric railroad to the Chain o' Lakes.

The council of Des Moines, Ia., has voted to set aside $20,000 for the construction and operation of the new municipal electric light plant.

The council of Fergus Falls, Minn., has purchased a 2,000 light dynamo from the receiver of the Standard Electric company of Chicago. He had only one of the kind in stock and to close it out offered it to the council for $1,000. The next lowest bid was $1,750.

W. F. Rowell and C. B. Slocum are now in charge of the electric light plant in Sturgis, S. D., and are making a number of improvements. The wiring is all being overhauled. A great improvement is noted there since the arc and incandescent systems were separated. C.

Canadian Intelligence.

Ottawa, January 10.—The Wallaceburg Electric Light company of Wallaceburg, Ont., contemplates putting in an incandescent plant in that town, having contracted to do so within eight months.

The Toronto Radial Railway bill now before the Ontario Legislature, asks for the consolidation of various local electrical railways. The lines when completed will have a radius of about 100 miles, and will run through several counties.

The Chatham City and Suburban Electric Railway company of Chatham, Ont., intends to secure the necessary amendment to its charter, in order to extend its road north and south, and it will at once push forward the work of construction.

The by-law to guarantee the sum of $50,000 for the building of an electric railway at St. Thomas, Ont., was carried by the ratepayers of that town by a large majority. Under agreement the company is bound to build 6½ miles of track.

During the fiscal year of 1896-97 the receipts for electric light inspection, in the Dominion of Canada, amounted to $6,895 and the expenditure to $9,021, of which only $1,830 was for salaries. The Ottawa Electric company is registered as maintaining 62,740 lamps in the city.

A company has been formed at St. Catharines, Ont., and plans have been matured for the purpose of building an electric railway between St. Catharines and Port Dalhousie. It is expected that the road will be completed and in operation sometime during May next. Mr. H. D. Symmes, manager of the St. Catharines and Thorold road, is the chief promoter of this enterprise.

A company in Detroit, Mich., has made a proposition to build an electric railway from the town of Amherstburg, Ont., to Windsor and Harrow, and in connection with which it demands a bonus of $15,000. Estimates for grading, bridge culverts, etc., have been made. Several bridges will be required if the road is to be proceeded with.

The Electric Light company of Dartmouth, Nova Scotia, has offered to dispose of its plant to the town for $30,000. By agreement the company is bound to give the first right of purchase to the town. The citizens' committee has replied that the plant is not suited to the requirements of the town, and it is probable that arrangements will be completed with a New York company, represented by Mr. C. K. Corsant, to purchase the plant. This company has in view the development of the water power at Fall River, at an expenditure of $100,000.

In respect to the proposed transmission plant at Goldstream, B. C., Mr. F. S. Barnard, manager of the British Columbia Electric Railway company, writes: "We have not yet definitely decided upon plans for a transmission plant. I may say, however, that our generating station will have a capacity of about 1,000 horse power, developed by water delivered under a 570 foot effective head. This power will be transmitted by a voltage of about 10,000 to the sub-section at the city of Victoria, B. C., a distance of about 12 miles, and there distributed for the purpose of street-car locomotion, arc and incandescent light and power circuits."

B. F. Pearson of Halifax, N. S., and William Mackenzie of Toronto were in Montreal recently completing arrangements for the construction of the electric street railway at Kingston, Jamaica. The work of construction is to be rapidly pushed during the winter months, so that by the next hot spell the inhabitants of that island may enjoy all the delights of rapid locomotion in hot weather, without the discomfort of personal exertion. Among those interested in this Jamaica syndicate are H. M. Whitney of Boston Mass., and F. S. Pearson of New York.

Another big electric deal has just been put through, at a cost of about $150,000. After considerable dickering the property, rights and franchises of the Temple Electric company of Montreal are about to be acquired by the Standard Light and Power company of that city. The deal was practically arranged over a month ago, but the directors of the Temple company only recently met and gave a formal ratification of the sale, which makes the Standard company one of the most important electrical concerns in Canada. Another feature of the deal is that while the Lachine Rapids Hydraulic and Land company does not supply the direct power to run individual motors, say for private lighting, elevators, etc., it will in future furnish the power to the Standard, under a contract just made, and which means the turning over of many thousands of dollars. The Lachine company has also brought to a successful consummation its efforts to supply power to the Imperial Electric company of Montreal for five years.

A comparative statement of earnings of the Montreal electric street railway shows the earnings for December to have been $113,128.91, as against $103,116.02 for the same month in the year before. The total earnings for the last three months in 1897 were $340,351.60, giving an increase over the like period in the year previous of $27,306.63.

Prominent men of Montreal recently made an excursion to Chambly, Que., for the purpose of passing an opinion upon the works of the Chambly Light and Power company. Among the number was F. S. Pearson, chief engineer of the Metropolitan Street Railway company of New York. Mr. Pearson gave it as his opinion that the Chambly plant was as perfect as any he had ever seen.

Mr. Henry Holgate, who for several years past, has managed the Montreal Park and Island railway, has resigned his position to take over the management of the West India Electric Railway company of Kingston, Jamaica. Mr. Holgate, whose work upon the Park and Island has given great satisfaction, served his apprenticeship with the Northern railway, and was chief engineer of the Northern and Northwestern railway from 1884 until 1892. Mr. Holgate will leave Montreal at once for New York, and will said for Jamaica before February 1st.

The Niagara Power company, if forced to develop power on the Canadian side of the line, must look to Toronto, it is said, for an immediate market, to which city the question of power transmission is already being considered by the company. The rival concern, which proposes to utilize the Welland River power, also looks to the city of Toronto for its most important market. The Electric Light company of Toronto, which has a large amount invested in plant for the production of electricity from steam, will not eagerly welcome the advent of water-produced power and is making a strong fight against its introduction. The people of Toronto, however, want Niagara power and want the City Council to run the electric business, and will not be satisfied until they have gained both.

The Dominion government proposes putting in an electrical installation in all the departmental buildings at Ottawa. At present the Parliament block furnishes its own electricity. The intention is to erect a power house to supply all the government buildings with electric lights and also with energy to work electric pumps for fire purposes in every building. The annual cost now for gas is $23,000, and an electric system is estimated to effect a saving of $13,000 a year. There will be about 4,000 incandescent lights in the several buildings to be supplied. The total cost is estimated at less than $80,000.

An important decision has been reached by the railway committee of the Ontario Legislature, now in session at Toronto, in passing the bill extending the time for building an extension of the Toronto electric railway through the village of East Toronto to Victoria Park. The municipality of East Toronto strongly opposed the bill. The object is ultimately to build to Highland Creek and on to Pickering, Whitley, Oshawa and Bowmanville. At present the road to York does not pay, but by extending the trolley to these eastern towns the enterprise may become a profitable one.

It is reported that an effort will be made at the coming session of the Manitoba Legislature to remove from the municipal act the clause which prevents the citizens of Winnipeg from voting on a Sunday electric street-car service by-law without the consent of the Legislature. This clause, it is alleged, found its way into the act only by a fluke, as it had been intended to vote down the motion favoring it, in committee, but through the misunderstanding of a member the arrangement miscarried

A motion has been introduced into the Ontario Legislature to the effect that, in the opinion of the House, the water power of Niagara Falls and rapids, being one of the great natural resources of the province, should be developed and utilized for the benefit of the Canadian people, and that to this end the government should favor all bona fide enterprises proposing the development of this power.

The Montreal Electric Street Railway company has just completed the printing of 15,000,000 street-car tickets. The issue cost of the tickets was in all about $1,100, and for the privilege of advertising on the back of each ticket the company received $3,000, making a clear profit of $1,900 upon the scheme. A. V. W.

PERSONAL.

R. H. Kilby, the London manager of the Armorite Interior Conduit company, died very suddenly on December 15th. Mr. Kilby was about 50 years of age and had had an extensive experience in England and Canada in the iron and steel trade. The English business of the Armorite company will be carried on by The Veritys, limited.

A handsome obelisk in memory of the late Captain Robert C. Halpin has been erected at Fitzwilliam Square, Wicklow, Ireland, and was unveiled there last October by the Viscountess Milton, wife of Viscount Milton, M. P. Captain Halpin was commander of the Great Eastern for several years, and with that [illegible] successfully laid thousands of [illegible] cable in various parts of the world.

James Graves, the superintendent of the Anglo-American Telegraph company at Valentia, Ireland, in a letter to the [illegible] London, gives some particulars of the [illegible] of his brother, Edward Graves, who was recently [illegible] at Kirwan, Persia. The [illegible] veteran in the English telegraph [illegible] he had entered the employment of the [illegible] and International Telegraph company in [illegible], when but a boy. He spent 34 years of his [illegible] and married his [illegible] wife, an Armenian lady [illegible] letter received from him by James Graves [illegible] dated New Year's Day, 1897, in which he stated that he [illegible] in Camp near Jask having left [illegible] on [illegible] 6, 1896, for the purpose of putting the land line in order, renewing insulators and stays, and removing numerous bad joints which had been burnt in the process of soldering; and he hoped to have all straight by January, 1898, and then shortly after his return to retire on his well-earned pension; "but," his brother concludes, "his hopes have been most cruelly frustrated by his recent barbarous murder." It is stated that the unfortunate man was hacked to pieces. The murder is being investigated.

ELECTRIC LIGHTING.

The good women of the Women's Christian Temperance Union in Chicago were recently disconcerted by the discovery that the isolated plant in their building, or rather the building erected under their auspices, the Woman's Temple, supplied current to a saloon in an adjoining building. The arrangement was made by the business agent of the Temple.

In London there is a street known as Electric avenue, and for many years it has attracted large crowds of South London residents as a brilliant shopping center. During the holiday season it was elaborately illuminated by the electric light to set off the displays of Christmas goods offered by tradesmen. Huge masses of foliage were utilized in the decorations, with a large number of incandescent lamps of all colors. The illumination was attractive, and made the avenue one of the sights of London, and a credit to Brixton, an extensive suburb not over-burdened with attractions.

The consolidation of the two light companies in Atchison, Kansas, has been perfected. The directors of the new company are J. P. Pomeroy, B. P. Waggener, W. P. Waggener, George Storch and J. P. Brown. The officers are: J. P. Pomeroy, president; W. P. Waggener, vice-president; C. S. Hetherington, treasurer; J. A. Bendure, general superintendent; J. M. Chisham, secretary. The Atchison Gas, Electric Light and Power company, for a consideration of $100,000, has conveyed all its property to the Atchison Railway, Light and Power company, and B. P. Waggener has conveyed Forest Park to the new company for a consideration of $25,000. The new company took possession of the consolidated plant on January 1st,. The lights of the old company will be supplied from the power house of the new company. For the present, however, and until the addition to the new company's power house can be completed, the machinery of the old company's power house will be operated between the hours of 6 and 12 p. m., to help out the new plant, which, with its present capacity, could hardly carry the load during the hours when all the lights are in use.

ELECTRIC RAILWAYS.

As a sequel to the recent generally-copied item about the woman who has been running a trolley car in an eastern city, the following dispatch from Middletown, N. Y., dated January 7th, is of interest: "Mrs. Mabel Brierley, the motorwoman of the Middletown-Goshen Traction company, was discharged to-day. The superintendent said she was a detriment and that the men on the line were dissatisfied at having a woman occupying one of their places."

The new trolley line of the Brunswick Traction company, between New Brunswick, N. J., and Bound Brook, a distance of seven miles, was formally opened last month. Edward Radel, secretary of the company, was the motorman on the first car run over the line. The farmers along the road gave the first car an enthusiastic welcome. At the farm of George W. Metlar there was a banner stretched across the road with the words: "Welcome to the Trolley." The opening of the line was of such interest to the merchants of the city, who hope for increased trade, that prizes were offered by several storekeepers to the persons first reaching the city from Bound Brook on the trolley.

TELEPHONE.

The Cumberland Telephone company has its lines completed to within 12 miles of Centreville, Md. It proposes to furnish service early in the year

War has been declared between factions of the Chicago Board of Trade over a movement to abolish telephones from the floor of the exchange. The fight is between firms having offices in the Board of Trade building and those outside the building, who rely greatly on the telephones to transact their business. Petitions and protests have been filed by members, and the question will be submitted to a vote of the members for final decision

ELECTRICAL SECURITIES.

The United Traction company of Pittsburg reports for December gross earnings, $127,504; expenses, $54,856, net earnings, $72,647, fixed charges, taxes, etc., $47,657; leaving a surplus of $24,990

Last week there was offered in New York at par $250,000 of the eight per cent preferred stock of the Electric Vehicle company of that city. The authorized capital stock of the company consists of $5,000,-000 preferred stock and an equal amount of common. Of the preferred stock only $60,000 has already been issued. The proceeds of the present offering, which is underwritten by a syndicate, is to be expended for expanding the company's plant, and no part of it for patents or franchises. The earnings of the company in excess of eight per cent. upon the preferred stock and the same upon the common are to be divided between the two classes outstanding, pro rata. One share of full-paid, non-assessable common stock will, under the terms of the present offering, be given to each subscriber to a share of the preferred stock.

Announcement is made of the placing on the market of $1,000,000 of Erie Telepgraph and Telephone company five per cent. collateral trust sinking fund gold bonds, due July 1, 1926, being part of $2,000,000, of which $1,000,000 have been sold. Both the bonds and stock of the company are quoted on the New York Stock Exchange. The company, in conjunction with the American Bell Telephone company, owns and operates the subordinate corporations conducting the Bell telephone business in Cleveland, O., and in Minnesota, North and South Dakota, and Texas and Arkansas, excepting only Duluth and the Black Hills district. The company has a capital stock of $4,800,000, upon which dividends have been paid continuously for 14 years. This issue of bonds is to provide the company with capital for extensions of its system. The net income of the company for 1897 was $365,-000, or twice the amount of its total bonded interest. The bonds are countersigned only to the extent of two-thirds of the collateral deposited under them, which collateral consists of the Erie company's ownership of the stocks of subordinate companies, and these are kept free from bonded or other indebtedness. The American Bell Telephone company owns the remaining capital of the subordinate companies, and is represented on their boards by two of its own principal officers.

MISCELLANEOUS.

It is said that the Westinghouse people are building a 750 horse power gas engine, and that one of 1,200 horse power is projected.

The report of the twentieth convention of the National Electric Light association, held at Niagara Falls, June 8, 9 and 10, 1897, is now at hand. It forms a volume of 456 pages, uniform in style with its predecessors. The frontispiece is a portrait of ex-President Frederic Nicholls. The minutes, papers and discussions of the meeting are given, and in an appendix the president's "interim reports" are given.

The report of a curious defense in a murder trial comes from Elmira, N. Y. A man named Orme was indicted for murder in the first degree for shooting James Punzo at Horseheads on July 8th at Orme's wife's house. Mrs. Orme was also shot, but she recovered. Punzo was taken to a hospital, where he died a month later. The physicians used X-rays to search for the bullet, and the defense maintained that this was the main cause of death. This plea seems to have influenced the jury, which returned a verdict of "not guilty."

TRADE NEWS.

Stanley G. Flagg & Co. of Philadelphia announce that they have opened a New York office in the St. Paul building, 220 Broadway, under the management of C. A. Jaynes.

The compliments of the National Automatic Fire-alarm company of Louisiana come to the Western Electrician in the shape of a box of lead-pencils. The company deals in electrical supplies in New Orleans.

Acknowledgment is made of the receipt by the Western Electrician of 1898 calendars from Bagnall & Hilles of Yokohama and Singapore, Morgan-Gardner Electric company of Chicago, Joseph F. Wangler of St. Louis and Alfred F. Moore of Philadelphia.

The Louisville corporation formerly known as the Sulzer-Vogt Machine company, has changed its name and is now the Henry Vogt Machine company. It will hereafter be known by that name. There will be no change of officers and the management of the company will be the same as heretofore.

Fred B. Robinson, manager of the Huntsville (Texas) Telephone company, in the course of a letter to the Western Electrician on another subject, states that he has 75 subscribers to his independent exchange at rates of $2 and $1 per month. The service is giving satisfaction to everyone, the only trouble being that Mr. Robinson cannot supply the demand for telephones. "I use the Stromberg Carlson telephone and switchboard," he adds, "and consider them the best made."

The delegates to the Northwestern convention, to be held in Milwaukee next week, will find many attractive exhibits at the Hotel Pfister. Meysenburg & Badt, Chicago, will be ably represented at the convention in the person of President F. B. Badt, assisted by R. F. Schuchardt, Rohn & Meyer and William Goltz, Wisconsin agents for Meysen-

burg & Badt. The firm will make an interesting exhibit, which will be found in a prominent place on the parlor floor of the Pfister. The exhibit will consist of new Helios alternating 100-hour lamps, also 220-volt, 2½-ampere, direct-current lamps, Hardy incandescent lamps, K. & W. specialties, the Ward Leonard Electric company's apparatus, etc.

The General Electric company will be represented at the Northwestern Electrical association convention at Milwaukee by the following-named gentlemen from its Chicago office: J. Scribner, R. A. Swain, P. A. Clisdell, F. N. Boyer, and by Thomas Ferris of Milwaukee. The General Electric company will make an exhibit, as usual at these conventions, which will consist of a full selection of wiring supplies, recording wattmeters, inclined-coil instruments, new transformers and long-burning arc lamps for direct current, alternating current, railway and power circuits. The company's headquarters will be in a special room at the Pfister Hotel, close to the clubroom where the meetings of the association will be held.

Treasurer W. H. Latshaw and President James F. Cummings of the Armorite Interior Conduit company, Pittsburg, visited Chicago last week. The Armorite company is making remarkable progress and the amount of this conduit that has been placed in New York city alone is astonishing. The company has recently brought out a new specialty in the shape of pipe for service in chemical works, salt mines and other industries where a non-corrosive pipe lining is required. The prospects for this new Armorite specialty are particularly bright, and there promises to be in it a new and profitable field for Armorite tubing. In addition to the above the company is also pushing a branch of business devoted to the manufacture of tubing trolley poles. In a word, the Armorite Interior Conduit company, with its splendid facilities for furnishing conduit of all kinds, is doing a business to be proud of.

The Dearborn Drug and Chemical Works, 31-33 Rialto building, Chicago, offer their services to all steam users as manufacturing and analytical chemists, whose specialty is the preparation of vegetable boiler compounds to prevent the formation of scale. Waters are analyzed free and the indicated compound for each is prescribed. In a little pamphlet issued by the company its position is thus outlined: "With an extensive and completely equipped laboratory, we are able to handle this subject, making preparations to overcome the different known deleterious actions taking place in the steam boiler, in a scientific manner, by analyzing the feed-water and making a diagnosis of the case at hand. We have no proprietary article on hand, but after learning with what we have to contend, we write a prescription for the ingredients and give such directions as will be suitable for the water used under the given conditions. This prescription is sent to our works, where it is filled, filed, recorded and numbered, and can be refilled when wanted, the same as a prescription is handled by a dispensing pharmacist in a drug store. In this way we are handling the subject in an intelligent and systematic manner, getting at the root of the existing evil, overcoming the difficulties and insuring the safe and economical running of steam boilers and all other receptacles. These methods also enable the steam user to always obtain identically the same especially-prepared and uniformly made preparation." The company also analyzes coal for its clients.

BUSINESS.

The Hobart Electric Manufacturing company of Troy, O., manufacturer of dynamos and motors and general electrical supplies, reports a healthy activity in its business for the beginning of the new year. It is sending its apparatus all over the country, and had to work nights all during the month of December.

A. M. Searles, manager of the Diamond Electric company, Chicago, states that his company has just placed on the market a new induction meter for light and power which is already meeting with great favor. This meter is said to possess a number of new and important features not to be found in other makes. The perfect workmanship and general reliability found in the products of the Diamond company has secured for it a large trade among users of electrical instruments.

Armorite interior conduit is now generally recognized by architects and contractors as a standard for all high-grade interior work. This conduit, as now made with the light steel wall and light lining, is superior to the old-style heavy conduit and is claimed to be displacing entirely the old type of tubing. The Electric Appliance company is carrying a large stock of light-wall steel Armorite in Chicago and is doing a handsome business. It claims that Armorite is easier to install than any other conduit that has yet been placed on the market.

The McDermid Manufacturing company, 207 South Canal street, Chicago, has just placed on the market an article which should appeal to every manager in the electrical business. It is a preparation which will remove dust, dirt, oil and grease from brass, woodwork, etc., and is already used largely by street-railway and lighting companies. Telephone managers can greatly improve the appearance of their exchanges by the use of this article, it is claimed. Further information will be furnished by the McDermid company on request.

L. F. Seybert's Sons of 437 North Third street, Philadelphia, who have for many years made a specialty of second-hand machinery, have recently added an electrical department, and have published a list of second-hand dynamos, motors, arc lamps, etc., which merits the investigation of a prospective purchaser of this line of electrical aparatus. This concern has been in business for over 30 years, and its reputation for business dealings has always been that of the best. The firm's list of second-hand electrical apparatus has recently been published, and is now ready for distribution.

H. B. Coho & Co. of 220 Broadway, New York, report that their business for the last year has been greatly in excess of that which was anticipated, especially the last six months, which was nearly double that of the same previous term of the year. This concern is rapidly forging ahead in the vicinity of New York as a contractor to install complete electric plants. Being able to install the Oswego boilers, the Eddy motors and dynamos, and the Warren alternators, Coho & Co. have the basis of being able to deliver an outfit from 50 lights up. The success which has attended the efforts of H. B. Coho & Co. is well merited, from the fact that their motto in business has been "A customer well served is two friends made in business."

The Filer & Stowell company, the Milwaukee engine builder, is busy. It is now building a 500 horse power cross-compound engine for the electric light plant for the city of Jacksonville, Florida. The engine is to be an exact duplicate of the two cross-compound engines furnished by the company for the electric light plant at Garfield Park, Chicago. The company is also building two engines for the electric light plant for the city of Donaldsonville, La., and a 1,000 horse power tandem Corliss engine for the new flour mill of the Eckhart & Swan Milling company, Chicago, and has just shipped an engine for the Minnesota elevator which Armour & Co. are erecting on Goose Island, Chicago, and a tandem of 250 horse power for the Riverside Fiber company, Appleton, Wis. Two cross-compounds of 300 horse power each have just been shipped for the new plant which Swift & Co. of Chicago are erecting at St. Joseph, Mo., while a single-cylinder engine for the electric light and water-works plant for the city of Brookhaven, Miss., and another for the city of Port Gibson, Miss., have also been shipped.

Much trouble and anxiety is caused by the deterioration of iron and steel pipes for conveying salt-water, sulphur, and other liquids in mines, salt wells, chemical works, etc. Several schemes have been advanced to prevent this rapid deterioration, which is very expensive. Pipes have been galvanized and coated with several materials; but none as yet have, it is believed, proven thoroughly satisfactory. The friction and "eating" of the liquid directly on the metal, soon honeycombs the pipe and renders it useless, thereby causing considerable expense as well as delay in replacing the line. The Armorite Interior Conduit company of Pittsburg is manufacturing "Armorite"— a wood-lined tube which, it is claimed, entirely overcomes this difficulty. An ordinary iron or steel pipe is employed and a wooden tube is forced into it that has been thoroughly treated to prevent the corroding liquid from penetrating it. The inside tube can be cut any desired thickness from one-sixteenth inch up; is made to fit perfectly tight in the metal pipe with flush joints, and it is coupled up in precisely the same manner as pipe would be lined. With this construction of tube, the liquid forced through the pipe does not come in contact with the metal, and has, it is stated, no effect whatever on the lining; thereby greatly increasing the life of the iron pipe, which would only be used for additional strength and mechanical protection. Those interested in this process may obtain free samples for inspection. The Armorite piping for this purpose is furnished at present in all sizes up to six-inch pipe, with larger sizes preparing.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued January 4, 1898.

596,483. Electric Fan. Oliver F. Conklin, Springfield, Ohio. Application filed June 17, 1897.

The motor is inclosed in a cylindrical casing and the armature and field coils are especially adapted to this construction.

596,496. Telephone. William Gray, Hartford, Conn. Application filed April 20, 1896.

Features enumerated are a transmitter, a sound passage to the transmitter diaphragm, a signal box and a tubular connection between the signal box and transmitter case forming a signal passage, having a deflector located outside of and with its outer surface flush with the wall of the sound passage.

596,506. Electric Switch. Warren S. Hill, Hyde Park, Mass. Application filed May 1, 1896.

The blade of a knife-switch has a recess near the end with an opening leading therefrom through the end of the blade to the exterior of the blade. There is a yoke, an insulating block placed intermediate of the blade and yoke, a nut seated in the recess formed in the blade and a screw passing through the yoke, insulating block and the opening in the end of the blade and engaging with the nut.

596,509. Signaling Apparatus for Telephone Systems. Frank J. Holmes, Cleveland, Ohio. Application filed March 25, 1896.

The first claim reads as follows: In a telephone or telegraph system, the combination of a device for varying the resistance in the line circuit one or more times, an electrically operated signal indicator connected in a local circuit, a plurality of devices which are adapted when connected severally in said local circuit to vary the resistance in said circuit according to a code, and mechanism adapted to be operated by varying the resistance in the line circuit for connecting in the local circuit any desired one of said devices.

596,512. Automatic Stop-motion Snap Switch. John D. Ihlder, Yonkers, N. Y. Application filed August 11, 1896.

An arrangement of gearing so that on moving the traveling operating means in one direction the connections will initially operate the switch and then permit the continuous movement of the traveling operating means without affecting the movement of the switch, but will, however, initially operate the switch on a reversal of the movement of the traveling operating means.

596,513. Compound Brake for Electric Elevators. John D. Ihlder, Yonkers, N. Y. Application filed September 14, 1896.

One claim is for the combination with the brake device of an elevator engine, of an eccentric, connections with the eccentric whereby it can be controlled by the operator, a strap mounted on the eccentric, a rod connected to the strap, a socket mounted on the brake device and a spring interposed between the strap and socket.

596,514. Safety Magnet Brake. John D. Ihlder, Yonkers, N. Y. Application filed September 21, 1896.

The mechanical part of this device comprises a band bearing on a pulley, a bearing connected to the band, a weight mounted on the bearing and a cam on the bearing. There is also a magnet, the armature of which is provided with a cam engaging the cam on the bearing, whereby the weight may be released and again set to its normal position.

596,515. Starting Box for Electric Motors. John D. Ihlder, Yonkers, N. Y. Application filed October 11, 1897.

The combination with the switch of a shaft, an arm connected to the shaft for operating the switch, a resistance device in the circuit, a brush carrying arm loosely mounted on the shaft, and connections between the arms, whereby when the switch operating arm is moved in one direction the brush-carrying arm is free to operate, and when it is moved in the other direction it is moved with the switch-operating arm.

596,567. Converter for Monophase Currents. Andre Blondel and Gaston Sautter, Paris, France. Application filed June 27, 1895.

A converter for the transformation wholly or partially of a monophase alternating current into a continuous current, or vice versa, comprising an armature carrying two windings, a primary winding fed by the alternating current to be transformed, and a secondary winding delivering the continuous current through a commutator, this armature being surrounded by a magnetic circuit formed by a fixed frame carrying a closed coil tertiary winding set in the pole-pieces, the tertiary winding having for its object to transform the simple alternating field into a constant field fixed in space.

596,582. Means for Varying Candle Power of Incandescent Electric Lamps. Charles E. Felch, Natick, Mass. Application filed June 21, 1897.

In a socket for incandescent electric lamps a rotatable shell, a carrier of insulating material mounted therein and having a recess, a permeable resistance medium held in this recess, an electrode adapted to be extended into this medium, and means connected with and actuated by rotation of the shell to effect relative movement of the electrode and carrier within the shell, and thereby extend the electrode into the resistance medium to different depths, the medium and the electrode being in electrical circuit with the lamp filament and the line.

596,600. Supervisory Signal for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill. Application filed October 26, 1896.

This device is described as the combination with a telephone line and means for altering its electrical condition of a signal indicator associated with the line, a magnet controlling the indicator responsive to currents in the line, an appliance whose position or condition is altered during connection with the line and a mechanical device actuated in the movement of the appliance adapted to act upon the indicator in the same manner that the magnet does.

596,610. Signaling System for Telephone Trunk Lines. Frank R. McBerty, Downer's Grove, Ill. Application filed November 24, 1896.

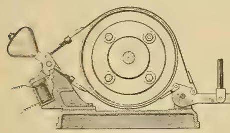
The first claim is quoted: The combination with a subscriber's line terminating in a spring-jack, a trunk line and a plug connected with the trunk line and adapted for insertion into the spring jack, of a signaling circuit including a clearing-out signal at the distant terminal of the trunk line, said signal being adapted to be displayed when its controlling magnet is inert, the signaling circuit being completed through registering contact pieces of the subscriber's spring jack and the plug therein, and a source of current permanently connected with the signaling circuit to excite the signal-controlling magnet, whereby the withdrawal of the plug from the spring jack causes the display of the clearing-out signal.

596,625. Plug and Spring-jack for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed November 29, 1895.

The combination with a spring-jack having a tubular contact thimble and a contact spring, of a plug having a contact ring for the contact spring and an insulating ring of larger diameter than the contact ring placed before the contact ring, whereby the ring is prevented from touching the contact thimble.

596,626. Spring-jack for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed May 14, 1896.

In a spring-jack with a base plate of insulating material having a transverse groove formed therein there is combined a group of line springs and anvil straps, with interposed tongues of insulating material lying on edge in the groove, lateral extensions from the anvil straps and from the tongue between them near the anvils of the straps, and a recess in the floor of the groove adapted to receive and fit tightly the extensions.



NO. 596,514.

596,627. Annunciator for Telephone Lines. Charles E. Scribner, Chicago, Ill. Application filed May 14, 1896.

With a closed signaling circuit there is an annunciator having its winding together with a resistance coil in the signaling circuit, a source of current in a normally open shunt about the resistance coil, switch contacts in the annunciator actuated by the excitement thereof to close the shunt and a switch adapted to break the circuit of the battery through the annunciator.

596,628. Supervisory Signal for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed November 16, 1896.

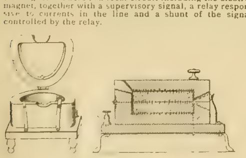
The combination with an operator's plug circuit, a listening key and the supervisory signals having signal-controlling magnets included in the plug circuit adapted to conceal the indicators of the signals when excited, of a mechanical device connecting the key with the indicator actuated by the key in connecting the telephone to the plug circuit adapted to conceal the indicators of the supervisory signals.

596,629. Testing Apparatus for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Application filed December 8, 1896.

The first claim describes the combination with a telephone line, spring-jacks therefor in different sections of a multiple switchboard and test contacts in the spring-jacks, of a relay responsive to currents in the line and a signal controlled thereby, a cut-off relay adapted to interrupt the current through the signal-controlling relay when excited, and means for applying current to the cut-off relay in the act of making connection with the spring-jack, a source of electric current and a circuit therefrom to the test rings closed by switch contacts actuated by the signal-controlling relay, whereby the circuit connecting the battery with the test rings is closed when the signal-controlling relay becomes excited, and it is broken when connection is made with the line.

596,630. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed December 8, 1896.

In this apparatus an electro-magnet is associated with the telephone line, with mechanism actuated by the electro-magnet. There is a local circuit including the electro-magnet, together with a supervisory signal, a relay responsive to currents in the line and a shunt of the signal controlled by the relay.



NO. 596,606.

596,654. Process of Producing High Vacuums. Elmer F. Deyer, Lynn, Mass. Application filed October 26, 1897.

The process consists in the case of an incandescent lamp of removing the bulk of the original gas by pumping, further expanding by heat the remaining gas and continuing the pumping, passing an electric current through the lamp [illegible] for dis[illegible]ging occluded or retained gases therefrom and [illegible] phosphorus [illegible] is applied to the connection while continuing the pumping and then finally sealing off the lamp.

596,672. Apparatus for Plate Glass Pictures. Karl Wirth, Nuremberg, Germany. Application filed December 17, 1896.

In this apparatus, applicable to show window display, there is [illegible], having it [illegible] to such a degree as to render it [illegible] reflecting objects, a picture mounted [illegible] and indistinguishable through the [illegible] condition, and an electric light [illegible] the picture and provided with means for lighting and extinguishing, whereby the picture may be [illegible] intermittently by intermittently [illegible] the light.

596,680. Alarm [illegible] Percy C. Howe, Boston, Mass. Application filed April 15, 1897.

The combination of an alarm clock, a thermostat, means operated by the thermostat for releasing the alarm train of the clock and of a circuit breaker operated by the alarm train.

596,696. Electric Oven. Levitt E. Custer, Dayton, Ohio. Application filed March 16, 1896.

This electrically heated oven has a heating chamber, walls of suitable materials, two apertures in such walls, one to allow light to enter the heating chamber and the other to permit observation of the interior, two or more electrical conductors embedded in the walls of the oven of substantially uniform resistance per unit of length, the conductors being arranged in the bottom and top halves of the walls in loops which are at progressively increasing distances apart as they near the center of the chamber, means for automatically making electrical connection between the conductors, means for placing the conductors in circuit with the heating current, and means for opening the oven to expose the heating chamber.

596,719. Magnetic Ore Separator. Lewis G. Rowand, Camden, N. J. Application filed April 15, 1897.

In a magnetic ore separator, the combination of a conveyer belt adapted to convey the material to be treated, a discharging belt passing over and beyond and at an angle with the conveyer belt, a magnet above the belts at the crossing point and extending above the discharge belt beyond the conveyer belt, the pole-pieces of the magnet extending along the discharging belt, the distance between the pole-pieces increasing along the discharging belt beyond the conveyer belt.

596,720. Magnetic Ore Separator. Lewis G. Rowand, Camden, N. J. Application filed April 15, 1897.

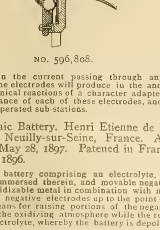
There is a conveyer and a magnet above it and adjacent to it. The pole-pieces of this magnet extend toward each other at their ends and are provided with an open-bottomed space between the free ends of the pole-pieces, the ends of the two pole-pieces being covered with non-magnetic material extending above their upper surfaces.

596,729. Support for Electric Lamps. Otis C. White, Worcester, Mass. Application filed February 16, 1897.

The combination of a support, a pipe pivotally connected thereto, a ball secured to the end of the pipe, an electric lamp fixture, a ball connected thereto, yoke-pieces and a single-clamping device for adjustably clamping the pieces into engagement with the balls.

596,774. Electric Signaling Apparatus. Felix B. Herzog, New York, N. Y. Application filed May 31, 1895.

An annunciator comprising a receptacle containing a transparent electrolyte and a series of electrodes located therein, visible therethrough and corresponding to a series of sub-stations, separate lines connecting these electrodes to the various sub-stations, a circuit-controlling device located at each sub-station and adapted to control the flow of current through its own line and electrode, the electrode and electrolyte being relatively so constituted that



NO. 596,808.

variations in the current passing through any one or several of the electrodes will produce in the annunciator electro-chemical reactions of a character adapted to vary the appearance of each of these electrodes, and thereby locate the operated sub-stations.

596,791. Voltaic Battery. Henri Etienne de Rufz de Lavison, Neuilly-sur-Seine, France. Application filed May 28, 1897. Patened in France October 15, 1896.

A voltaic battery comprising an electrolyte, positive electrodes immersed therein, and movable negative electrodes of oxidizable metal in combination with means for heating the negative electrodes up to the point of oxidation, and means for raising portions of the negative electrodes into the oxidizing atmosphere while the remainder is in the electrolyte, whereby the battery is depolarized.

596,806. Apparatus for Telephones. Frank B. Cook, Chicago, Ill. Application filed March 17, 1896.

In a telephone system in which a plurality of subscribers are connected in one circuit a central switchboard, means for preventing a false signal consisting of calling-generators at each subscriber's station, signal bells for each subscriber's station unresponsive to the current from the calling generators of the subscribers, signaling devices at the central switchboard operated by the current from the subscribers' generators, and a central switchboard generator to the current from which the signal-bells of the subscribers are responsive.

596,808. Telephone Transmitter. David A. Fleming, Indiana, Pa. Application filed April 12, 1897.

A tube or channel is mounted to turn adjacent to the diaphragm and inclined relatively to the axis of rotation, the tube being mounted to turn without affecting the fastening of the diaphragm, and loose conducting material, such as balls, is provided in the channel, engaging the diaphragm.

596,812. Subterranean Electric Conduit. William D. M. Howard, Redwood City, Cal. Application filed June 18, 1897.

The form of conduit is provided with a slot or channel with a hollow tube interior to the conduit having a channel in its bottom and inturned edges forming guide rails, vertical standards fixed in the conduit and passing through the channel of the tube and into the interior of the tube, and secured to the inner circumference thereof, trolley wires or rods within the tube and supported from the standards and a plow having guide wheels to engage the inturned edges of the tube.

596,834. Telephone Transmitter. James H. Spencer and Malcolm S. Keye[illegible], New York, N. Y. Application filed January 14, 1897.

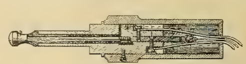
The transmitter is provided with buttons having their opposing faces formed with concentric grooves, and a transmitting device held loosely between the buttons and comprising a disk having pins projecting from its faces to engage the faces of the buttons.

596,850. Telephone Switch Plug. Frank B. Cook, Chicago, Ill. Application filed January 4, 1896.

A plug for complete metallic circuits consisting of a main body portion, comprising a head and conductor-holding members or sections insulated from each other, an insulating partition for insulating the sections, binding screws in each of the sections located on each side of the partition, and conductors led and secured to the screws, whereby the partition isolates the conductors to prevent short-circuiting, together with a conducting sleeve connected with the head of the plug, and a conducting stem connected with one of the conductor holding sections.

596,851. Telephone Apparatus. Frank B. Cook, Chicago, Ill. Original application filed November 30, 1894. Divided and this application filed October 23, 1895. Renewed October 25, 1897.

One claim provides for a combined ringing and listening key, consisting of a supporting frame including a base-piece held therein, spring-contacts mounted in the base and



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projected upward therefrom, inner and outer conducting frames and spring-contacts held by the frames, together with a listening-key lever centrally positioned, and ringing-key buttons located at either side of the lever, each one of which is operable independently of the other.

596,852. Switch for Telephone Circuits. Frank B. Cook, Chicago, Ill. Original application filed March 25, 1895. Divided and this application filed December 1, 1896. Renewed October 25, 1897.

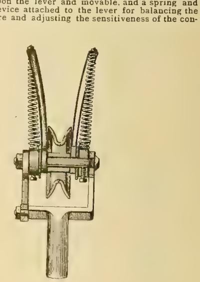
A pair of crossed springs is adapted for contacting at two points on the opposite sides of each, and means are provided for operating the springs to establish or disestablish the contacts.

596,907. Electric Cable for Propulsion of Vehicles. Addison Norman, Toronto, Canada. Application filed July 8, 1896.

The supply conductor is made of one or more strands of wire, and covered throughout its whole length with insulating material, except where it is inclosed by short metal switches, with the working conductors and switches knit into one rope.

596,923. Automatic Potential Regulator for Dynamos. Allen A Tirrill, Whitefield, and Phill S. Tirrill, Groveton, N. H. Application filed May 1, 1897.

This apparatus consists of one or more vertical solenoid coils arranged in a branch of the main supply circuit, a vertical core for each solenoid, a lever fulcrumed above and outside of the solenoid and attached to and suspending the core of the solenoid, contact points arranged as terminals to a shunt from the field-magnets of the dynamo, one of the contact points being stationary and the other mounted upon the lever and movable, and a spring and adjusting device attached to the lever for balancing the solenoid core and adjusting the sensitiveness of the contacts.



NO. 596,926.

596,926. Trolley Guard. Herman J. Vogler and Alfredo Flores, San Antonio, Texas. Application filed October 16, 1897.

The combination with the trolley wheel and its axial bolt of bowed or loop-shaped guards hung loosely on the axial bolt on each side of the trolley wheel, and a spring on each side connected at one end rigidly to the axial bolt and extending radially into the bow of the guard and secured within the bow to the middle of the outer portion of the same.

596,943. Electric Clock. Frederic Richard, Lynn, Mass. Application filed August 21, 1896. Renewed November 24, 1897.

The motion of the balance-wheel is electrically transmitted to the clock mechanism.

596,955. Automatic Temperature Regulator. Addy A. Boss, Detroit, Mich. Application filed March 31, 1897.

In this device an electric circuit having a circuit-closer therein, an electro-magnet, movable armatures, a valve-case and a valve therein, a lever for actuating the valve, and a connection coupling the armatures to the valve-actuating lever are enumerated. The connection is of such a character as to permit the armatures to attain their maximum velocity when attracted before acting upon the lever.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, JANUARY 22, 1898. No. 4

M. K. Bowen, President Chicago City Railway Company.

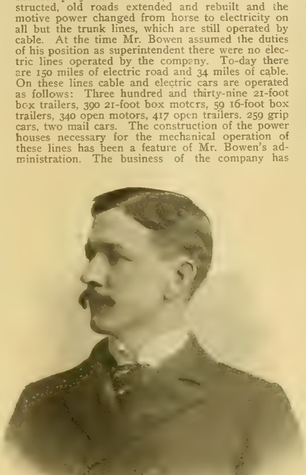
At the annual meeting of the Chicago City Railway company on Saturday, January 15th, Menard Kenner Bowen was elected president to succeed George H. Wheeler, who announced his decision to withdraw from the active management of the South Side railway system. This action had been anticipated for some time, and consequently little surprise was manifested in street-railway circles over the change, although Mr. Bowen's advancement in the service of the company has been unusually rapid. He has been identified with the corporation only six years, and in that time has risen from the comparatively obscure position of assistant superintendent to the presidency of the company. He is undoubtedly the youngest man in the street-railway world holding such an important position, but that he is qualified to administer the office is universally admitted by those who are familiar with his record as superintendent and general manager. Before he came to Chicago he had had practical experience in the management of street-railway properties, and his duties with the South Side company have broadened his views, and to-day he is considered one of the best equipped street-railway managers in the country. As yet there has been no official announcement of the policy of the new administration, but it is anticipated that many changes will be made and that the general attitude of the company will be much more aggressive than heretofore.

The new president of the Chicago City Railway company is a severe disciplinarian, and this characteristic may be traced to his early training. He was born in Jefferson Barracks, Mo., the army post on the Mississippi River, 10 miles below St. Louis, in 1858. He was the son of General John S. Bowen, who was graduated at West Point, and a grandson of Pierre Menard, the first lieutenant-governor of Illinois. He received his early education at the St. Louis University and later took a course in engineering at the Washington University in St. Louis.

At the age of 19 Mr. Bowen entered the service of the United States government as assistant engineer on a triangulation survey of the Mississippi River, and later he was made assistant engineer of the jetty work in the harbor of New Orleans and the pass. In 1880 the St. Louis and San Francisco Railway company placed him in charge of the topographical survey from Fort Smith, Ark., through to California. He was engaged in this and similar work for several years and then drifted into the street-railway field, which was just at that time attracting attention among capitalists and engineers, as the possibilities of mechanical propulsion in city traffic were becoming apparent.

The scene of Mr. Bowen's first important undertaking in the new field was Kansas City, where he became chief engineer and superintendent of construction of the Kansas City Railway company, which was building its cable lines at that time. He was successful in this enterprise, and when the road was completed he was retained as general superintendent of the system. This was an entirely new field, but Mr. Bowen was as successful in the operation and management of transportation property as he had formerly been in designing and constructing it. In spite of the limited field in which he was occupied, Mr. Bowen's ability and enterprise attracted attention, and he received many flattering offers. The Short Electric Railway company of Cleveland, which was at that time engaged in introducing Prof. Short's single-reduction and gearless motors for street-railway service, induced Mr. Bowen to enter the commercial field as its New York representative. His record with the Short company was very creditable to him and satisfactory to the company.

At this time the Chicago City Railway company was looking for a practical and experienced street-railway man to assist Mr. Holmes, who then had entire charge of the management and operation of the South Side system. The company was introducing the cable in State street and Cottage Grove avenue, but the remainder of the system comprised horse-car lines. Mr. Bowen's experience as an engineer and the ability he had already displayed in building and operating the Kansas City road, and his familiarity with the electrical system as well, commended him to the Chicago company, and he was appointed assistant superintendent. This arrangement proved satisfactory, and one year later, when the reorganization of the company took place, Mr. Bowen was promoted to the position of superintendent, which he held until last year, when the office of general manager was created, and he was the first to fill it. In all this time, it may be mentioned, Mr. Bowen did not appoint an assistant superintendent, in spite of the fact that his duties and responsibilities were constantly increasing. During the last few years, it may be remarked, he has had practically entire charge of the Chicago City Railway company's system. During the five years that he filled the positions of superintendent and general manager many changes and extensions were made, methods of conducting the business of the company were revised, new lines were constructed, old roads extended and rebuilt and the motive power changed from horse to electricity on all but the trunk lines, which are still operated by cable. At the time Mr. Bowen assumed the duties of his position as superintendent there were no electric lines operated by the company. To-day there are 150 miles of electric road and 34 miles of cable. On these lines cable and electric cars are operated as follows: Three hundred and thirty-nine 21-foot box trailers, 390 21-foot box motors, 59 16-foot box trailers, 340 open motors, 417 open trailers, 259 grip cars, two mail cars. The construction of the power houses necessary for the mechanical operation of these lines has been a feature of Mr. Bowen's administration. The business of the company has



M. K. BOWEN.

greatly increased owing to natural growth and somewhat to the change in motive power and extensions by which better service is secured. During the last year the company operated 24,37[illegible],000 car-miles, carrying 95,621,112 passengers and earning $4,781,055. This was an improvement over the previous year.

Under Mr. Bowen's direction the rails throughout the entire system have been cast-welded. The experience with this construction has been thoroughly satisfactory. An innovation in street-railway practice introduced by Mr. Bowen was the use of a dynagraph car, which is an ordinary car equipped for the purpose of det rmining and showing the condition of the track over which it passes. The test enables the management to determine just how much money will be required to reconstruct the track and put it in first-class shape. Mr. Bowen described this device and the method of operation and related the results which he had obtained through its use in a paper on "Track and Track Joints" before the American Street Railway association at St. Louis in October, 1896. This paper was printed in the Western Electrician, November 7, 1896, and attracted attention abroad as well as in this country. It was generally agreed that the dynagraph was an important addition to the equipment of every well-conducted street railway, and it is now in general use in all large cities. The beveled-head rail first adopted by this company resulted in the saving of the difference between 7½ and 3⅞ car wheels per day, as the average output of the repair shops. It may be mentioned here that many interesting and valuable labor-saving devices have been introduced in the shops and many economies practiced since Mr. Bowen took charge of the system. In the early days of cable railroading, for instance, it was necessary to take the grips out of the grip cars on the street, thus blockading the line, and draw the grip cars by horses into the car barns. They were taken out in the same manner, and the trains were made up on the street. This crude method cost about $34 at each barn per day for labor and resulted in numerous delays and blockades to service. The barn floors are now elevated 4½ feet above a sub-floor and are 16 inches higher than the street track. The trains are made up, grip hanging in place, and run out of the barns by gravity and run into the barns by momentum taken from the cable. The change has not only effected a material saving in the cost of operation, but it has greatly relieved the congestion at the car barns and facilitated the service.

Mr. Bowen has kept constantly in touch with the several departments over which he has had supervision, and one of the means he has employed has been the holding of weekly conferences with the heads of departments. These assemble at a determined time and place and devote an hour to the discussion of some practical topic of importance.

During Mr. Bowen's connection with the South Side company he has had many difficult and vexatious subjects to consider. His course has been upheld on all occasions by the directors, and, although he has at times departed from the path of the conservative management that had come to be looked upon as the fixed policy of the corporation, his action has found favor with the controlling spirts in the company. It is not at all improbable, therefore, that with complete control Mr. Bowen will soon introduce changes in the management that will make it more aggressive than heretofore.

New York Electrical Society.

On January 12th the New York Electrical society had its 184th meeting at the College of the City of New York, where most of this season's meetings will be held. Mr. S. Dana Greene read an interesting paper on "The Relations between the Customer, Consulting Engineer and the Electrical Manufacturer." This paper is begun on another page.

The members elected were: Otto Rothenstein, Otto Electric company, Times building, New York city; F. K. Vreeland, 228 Orange road, Montclair, N. J.; F. V. Henshaw, 79 State street, Brooklyn, N. Y.; S. L. Griswold Knox, Crocker-Wheeler Electric company, Ampere, Newark, N. J.; John Neilson, Larchmont Electric company, Larchmont, N. Y.; Putnam A. Bates, 113 West Seventy-second street, New York city; E. E. Higgins, 36 Cortlandt street, New York city; Thomas A. Edison, Jr., 96 Broadway, New York city.

At the request of the president the secretary read the following announcement:

"For some time past, the New York Electrical society has been considering means for enlarging its scope of usefulness and addressing a larger clientage among the citizens of New York, so as to bring the public into more intimate relations with the scientific aspect of all classes of electrical work. The proposition to hold an electrical exhibition at Madison Square Garden next May appeared to the society to afford it the needed opportunity for putting itself prominently before the public as the oldest electrical body in the country, and the recognized local society, aiming by papers and discussions to diffuse the best electrical information.

"The Electrical Exhibition has very promptly and generously met the views of the New York Electrical society, and has not only apportioned it space in the exhibition hall for a booth and rendezvous for its members and friends, but has also placed at its disposal a contribution of funds for its educational work. This amount will be increased by a percentage of the admission receipts of the exhibition, which is to be held under the auspices of the New York Electrical society. Members of the society will be admitted to the exhibition at half price.

"It is believed, from what is already known, that this exhibition will surpass anything of the kind ever done in this city, and will, during the continuance of a month, not only do much to promote electric interest, but enable the society to reach a great many thousand people who should know of

its work, and many hundreds who should unquestionably be in its membership.

"The Electrical society is now organizing committees and laying plans for a hearty and active co-operation in the work of the exhibition, and looking, of course, to its own increase of membership and its fuller recognition as an authoritative, influential body.

"It is hoped and expected that this will mark the beginning of one of the most successful steps ever taken by the society, and approving comments of friends and members encourage the executive committee to believe that they will be enthusiastically supported in the programme, the sole object of which is to increase and extend the society's usefulness. The officers would, therefore, not only urge the members of the society, individually and collectively, to assist in making the exhibition as brilliant a success as possible, for the direct benefit that such success will confer on the society, but also wish to impress on members the desirability of active co-operation, with a view of increasing the membership (a membership which, now standing at 400, should be at least a thousand before the year is out).

"It has been suggested that the advisory committee of the society, representing its interests, with the officers of the exhibition, and for other exhibition purposes, should consist of the present officers [M. I. Pupin, George H. Guy and Henry A. Sinclair] and all the living ex-presidents, namely: Frank W. Jones, John M. Pendleton, Francis B. Crocker, Joseph Wetzler, C. O. Mailloux, John W. Lieb, Jr., and C. E. Emery, all of whom, it is understood, will gladly co-operate in this movement to develop work to which they themselves have so actively contributed in past years."

A resolution approving the arrangement with the Electrical Exhibition and pledging support to it was adopted.

George O. Nagle.

A. C. Heidelberg.

NEW OFFICERS OF THE CHICAGO CITY RAILWAY COMPANY.

New Officers of the Chicago City Railway Company.

One of the first acts of President Bowen of the Chicago City Railway company was the appointment of a superintendent to perform part of the work that had formerly been borne on his own shoulders. For this position he named George O. Nagle on Tuesday, and the appointment was confirmed by the directors. The position of assistant superintendent was created, and A. C. Heidelberg was appointed to fill it. Both appointments are in the line of promotion, and both give satisfaction. Mr. Nagle has been thoroughly trained in Mr. Bowen's office in the executive supervision of the road, and several years' experience has fitted Mr. Heidelberg to look after the practical details of construction, maintenance and car operation.

George O. Nagle, the new superintendent, is a young man for so responsible a position. He was born in Milton, Pa., on December 31, 1868. He received his education principally in the public schools of Lima, O., to which town his family removed when the boy was seven years old. In the fall of 1886 the Nagles came farther West, removing to Chicago, where George attended the Athenæum. The young man started out to make his own way in the world the year following, securing employment with the Cragin Manufacturing company. A few months later he obtained a position in the office of the general auditor of the Chicago, Burlington and Quincy Railroad company, remaining there for nearly four years.

On February 8, 18[illegible], Mr. Nagle entered the service of the Chicago City Railway company as assistant to M. B. Starring, assistant general counsel of the company. Later in the [illegible] year he became private secretary to [illegible], then the superintendent of the system, but succeeded two weeks later by M. K. Bowen. Mr. Nagle continued in the same capacity under Mr. Bowen for over [illegible] years. As the importance of Mr. Bowen's duties increased with the growth of the system, the usefulness of his quick, intelligent and tactful secretary likewise became more apparent. A year ago Mr. Bowen was made general manager, and from that time, and indeed for several months previous, Mr. Nagle was virtually assistant superintendent. He acted in Mr. Bowen's absence and looked after much of the detail work in the office. He is thoroughly familiar with all the work of the operating department, and so, upon Mr. Bowen's advancement to the position of president, Mr. Nagle's promotion to the position of superintendent comes as a deserved recognition of faithful and efficient service.

In 1894 Mr. Nagle organized the Chicago City Railway Employés' Mutual Aid association. He became the first president of the organization and has been re-elected regularly ever since. This association has 2,100 members and maintains a benefit fund sustained by small assessments, from which the family of each deceased member receives $500. The average cost to each member of each death is 25 cents, and there were 12 deaths in the year ended October 1, 1897. At that time the aggregate insurance in force was over a million dollars, and there were over 400 members who had left the company's employment but still paid dues and assessments regularly. The president of this association is elected by a board of directors chosen by the men themselves, and it is a noteworthy fact that Mr. Nagle was re-elected last October, without opposition, at a time when the strike talk was at fever heat. Mr. Nagle strives to be entirely fair and impartial in dealing with the men, who recognize the fact.

The new superintendent is as yet unmarried, and lives at home with his mother and sisters.

A. C. Heidelberg, the assistant superintendent, has had the best kind of training for his new position. Successively, he has been gripman, assistant supervisor, depotmaster and trackmaster. He held the last-named position for two years before his recent promotion. Mr. Heidelberg is thoroughly versed in the practical details of the operating department of the great company with which he is connected.

Chicago City Railway Company's Annual Meeting.

At the annual meeting of the Chicago City Railway company, Saturday, January 15th, George H. Wheeler resigned as president and M. K. Bowen, general manager, was elevated to the position made vacant. He will hereafter combine the duties of president and general manager. William B. Walker was elected first vice-president, to succeed James C. King, resigned, and Joseph Leiter was made second vice-president, to succeed E. M. Phelps, resigned. The following-named gentlemen were elected directors: Samuel W. Allerton, M. K. Bowen, D. G. Hamilton, Joseph Leiter, George T. Smith, William B. Walker, George H. Wheeler.

The only change made in the directorate was the substitution of the name of George T. Smith for that of D. K. Pearsons, who resigned, but the changes, as compared with the list of directors elected at the annual meeting a year ago, were unusually numerous for this corporation. Only three of the men elected in January, 1897, remain in the present board. These are George H. Wheeler, Samuel W. Allerton and William B. Walker. Several months ago L. Z. Leiter resigned to make way for his son. Then William B. Walker withdrew to make a place for D. G. Hamilton. Later, John C. King and E. M. Phelps were succeeded by M. K. Bowen and William B. Walker, the latter having consented to return to the board. The utmost unanimity prevailed, all the stock represented at the meeting, amounting to 73,804 shares, being voted solidly for the ticket named.

The stockholders at the annual meeting on January 15th did not elect the treasurer and secretary owing to the lateness of the hour. During the week, however, the formality of electing T. C. Penington and E. R. Greene was complied with. Mr. Penington has been treasurer of the company since February, 1872, and Mr. Greene has filled the office of secretary acceptably for several years.

From the reports submitted it appears that the year 1897 was a good one with the company. The receipts from passengers increased $19,110 and the total receipts from all sources increased $7,650, while the operating expenses decreased $68,225, being 60.84 per cent. of gross earnings in 1897, as against 62.52 per cent. in 1896. The amount charged off to depreciation was $131,568 less than in 1896, so that the net profits of the company applicable to dividends showed an increase over 1896 of $207,444, being 13.47 per cent. on the stock, as against 13.42 per cent. earned on the stock in 1896. By virtue of the $1,250,000 increase in the capital stock of the company the amount paid out in dividends increased $150,213. Yet the surplus for the year increased $57,231, as compared with the surplus of 1896, being equal to 1.74 per cent. on the company's stock, as against 1.42 per cent. in 1896. The financial showing of the company, compared with that of 1896, is as follows:

	1897.	1896.	Changes.
Passenger earnings	$4,781 055	$4,761 945	*$19,109
Other sources	35,461	46,921	†11,459
Total income	$4,816,516	$4,808,866	*$7,650
Operating expenses	2,908,982	2,977,208	†68,225
Net earnings	$1,907,534	$1,831,658	*$75,870
Bond interest	$207 877	$207,877	....
Depreciation	50,000	181,568	*$131,568
Earnings on stock	$1,649,655	$1,442,212	*$207,444
Dividends paid	1,444 000	1,289,787	*150,213
Surplus	$209,656	$152,425	*$57,231
Surplus brought forward	534 606	382,180	*152,425
Total surplus carried forward	$744,262	$534,605	*$209,656
Percentage operating expenses to gross receipts	60.84	62.52	† 1.68
Earnings applicable to dividends	13.74	13.42	*0 32
Dividends paid	12.00	12 00	....
Surplus for year	1.74	1 42	*0 32
Capital stock	$12,000,000	$10,750,000	*$1,250,000
Bonds, 4½ per cent	4,619,500	4 619,500	....

*Increase. †Decrease

President Wheeler's report contained some interesting statistics regarding the operation of the system and the present condition of the property:

Revenue Car-miles Run During the Year.

		Per ct.
Cable lines	12,562 610	51 532
Horse lines	198,860	0.816
Electric lines	11,616 530	47 652
All lines	24,378,000	100 00

Showing changes over 1896 as follows:

	Miles.	Miles.
Cables, decrease	1,315 580	
Horse, decrease	427,830	
		1,773 410
Electric, increase		1,598,510
Total decrease in service		174,900

Number of Revenue Passengers Carried.

	Passengers.	Per ct.
By cable lines	41 444 636	43 342
By horse lines	691,051	0 723
By electric lines	53,485,425	55.935
All lines	95,621,112	100 00

Being a net increase over previous year of 382,197 passengers, as follows:

Electric lines, increase		7 556,552
Cable lines, decrease	4,990,775	
Horse lines, decrease	2,183,580	
		7,174,355
Net increase		382,197
Percentage of increase		0.401

The increase was made in February, March, September, October, November and December. January, April, May, June, July and August showed decreases.

Receipts During the Year.

From revenue passengers		$4,781,055.57
From miscellaneous sources		35 461.23
Making total receipts		$4,816,516.80
Cost of operation, including insurance and taxes	$2,908,982.80	
(60 84 per cent. of passenger receipts.)		
(60 [illegible] per cent. of total receipts.)		
Interest on bonds, $4,619,500 4½ per cents.	207,877.50	
Depreciation on cables	50,000.00	
		$3,166,860.30
Leaving net earnings		$1,649 656.50
Paid dividends, 12 per cent. on $12,000,000		1,440,000.00
Balance to surplus		$209,656.50
Percentage of earnings applicable to dividends		13.747
Percentage dividends paid		12.000
Surplus		1.747

Statistics.

Passenger receipts, per day	$13,098.78
Increase over 1896, per day	88 00
Expenses per day	7,969.81
Decrease from 1896, per day	164.64
Net receipts per day	5,128 97
Increase per day	252.64
Net loss on horse lines for the year	13,365.66
Decrease from 1896	5,144.35

Cost of operating per car mile	1897. Cents.	1896. Cents.
Cable lines	10 706	10.540
Horse lines	24.096	25.889
Electric lines	13 051	13 467
All lines	11.932	12.126

Motive Power.

Power house, Forty-ninth street and Oakley avenue, with equipment was completed during 1897, furnishing power sufficient to operate [illegible] cars.

The report explains that during the year 5.5 miles of new single electric track was constructed as follows: Three miles covering a route on Morgan street, from Thirty-ninth street bridge to Thirty-

first street; on Main street, from Thirty-first street to Archer avenue, and on private property connecting Morgan and Main streets, and 2.5 miles on Fifty-first street, from Halsted to Wood streets. The following tracks were changed from horse to electric operation: Twenty-second street, from State street to the river, 1.35 miles, and Sixty-third street, from Kedzie avenue to Central Park avenue, one mile, a total of 2.35 miles. During the year the company paved 58,931 square yards as follows: Asphalt, 3.195.6 square yards; white oak blocks, 814.5 square yards; cedar, 29,599 square yards; granite, 12,221.3 square yards; brick, 5,062.8 square yards. A total of 9,759 cast-weld joints were made, 9.108 of which were new ones and 651 took the place of broken joints.

The company owns 1,812 cars and operates 189.72 miles of track. There are 149.74 miles of electric, 34.75 miles of cable and 5.23 miles of horse-car lines.

Death of Benjamin Butterworth.

After a long illness, Benjamin Butterworth, the United States commissioner of patents, died in Thomasville, Ga., on January 16th. Mr. Butterworth went to Thomasville about three weeks before his death, thinking to recuperate from a severe attack of pneumonia which, complicated with the effects of a kidney disease, had exhausted his vitality and left him unfit for the performance of his official duties. The first seven days of his stay showed marked improvement in his condition, and his friends began to hope that he would soon be himself, but three weeks ago he was suddenly attacked with uræmic convulsions. From that relapse he never recovered. His wife and children were telegraphed for and were with him when he died.

Mr. Butterworth had been long in public life and was a man of great charm of character and manner. "Rare Ben Butterworth" was a favorite appellation of his friends. "The most popular man in Washington," says one of wide experience of life in the capital, while a Chicago patent lawyer who knew him intimately testifies that he "had more personal magnetism than any other man in the United States." He was a good lawyer and an exceptionally gifted orator. Twice he was commissioner of patents—once for a year and a half under President Arthur and again, under President McKinley, for the nine months prior to his death. It was only after considerable hesitation that he consented to accept the office for a second time last April, but as soon as he did so he entered upon the discharge of its duties with zeal and energy. He found much to improve and correct and labored earnestly to better the service.

Benjamin Butterworth was born of Quaker parentage about 60 years ago on a farm near Cincinnati. He was educated in that city, which was his home for many years, and there he studied law and was admitted to the bar. He served in the army during the war, and rose to the rank of captain. Returning to Cincinnati, he resumed the practice of law and soon achieved prominence in Republican politics. His services as an orator were in great demand, especially during political campaigns, and this remained true throughout his whole career. Mr. Butterworth added greatly to his reputation by his service in Congress during the '80's. He served four terms as a representative from his native state and was noted for readiness in debate and valuable service on committees. In his second term he was a member of the committee on appropriations, and he also served on the committee on patents, of which he became chairman. In 1883 Mr. Butterworth was one of the special counsel of the government appointed to prosecute the election cases in South Carolina. In October of the same year President Arthur appointed him commissioner of patents, and he served until March 3, 1885, when he resigned to re-enter Congress.

After leaving Congress Mr. Butterworth practiced patent law in Chicago and Washington until 1892 when he was appointed secretary and solicitor-general of the World's Columbian Exposition company. He was greatly interested in the World's Fair, and assisted in entertaining many of the distinguished visitors to Chicago in 1893. After the exposition Mr. Butterworth removed to Washington and resumed his law practice until the time of his appointment as commissioner of patents by President McKinley, to succeed John S. Seymour.

Mr. Butterworth is survived by his wife and four adult children. The funeral services were held in Washington on Wednesday and were attended by the president, several members of the cabinet and many officers of the government in high position.

International Electrical Gathering in Texas.

Arrangements have just been completed for a joint meeting of the Texas Gas and Electric Light Association, Texas Street Railway association and Mexican Gas, Electric and Street Railway association at Laredo, Texas, on March 9th. An active joint committee has been placed in charge of affairs, and a successful and largely attended convention is anticipated. It is said that the number of representatives of Mexican plants may reach a thousand. Good papers are assured and a large hall for exhibits has been offered.

Bell Telephone Companies Report Good Business.

On January 19th the annual meetings of the two Bell telephone companies of Chicago were held. Both companies reported an increase in net earnings. The general statements are given.

CHICAGO TELEPHONE COMPANY.

Following is the financial statement of the company for the calendar year:

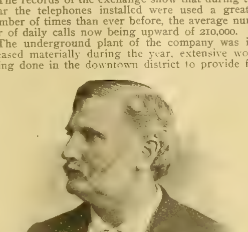
	1896.	1897.
Gross earnings	$1,955,829.03	$2,072,079 55
Expenses	1,355,624 05	1,447,386 08
Net earnings	$ 600,204.98	$ 624,693.47
Dividends paid	499 224.00	520,380 00
Surplus for year	$ 100,980 98	$ 104,313 47
Capital stock outstanding January 1, 1898		$4,336,500 00

At the close of the year 17,689 telephones were operated by the Chicago Telephone company. Of these, 14,105 were in the Chicago telephone exchange, which increased about 1,200 telephones during the year. A large portion of this increase was in telephones placed in private residences, for which a number of new and advantageous rates have been offered.

The plant of the company in the Chicago exchange now comprises 39,961 miles of wire, being an increase of 4,189 miles during the year. Of the above less than 8,800 miles of open wire is now carried on poles, 23,850 miles being contained in underground cables and 7,315 miles in cables attached to poles.

The records of the exchange show that during the year the telephones installed were used a greater number of times than ever before, the average number of daily calls now being upward of 210,000.

The underground plant of the company was increased materially during the year, extensive work being done in the downtown district to provide for



BENJAMIN BUTTERWORTH

the wires leading to two new exchanges which are now being established. The first, to be known as "Central" office, will be opened in the Title and Trust building, 100 Washington street as soon as the necessary switchboards can be obtained. New and enlarged accommodations have been arranged for the "Harrison" office, which, at a later date, will be removed to the Manhattan building, 307 Dearborn street. A new exchange is also to be established this year a short distance west from the river. In these new exchanges the operating apparatus will be of the latest design, by which the subscriber is enabled to control the movements of the operator by means of electric light signals, as in the express system.

About one half of the total number of telephones in Chicago are now of long-distance pattern, operated upon metallic circuits, and the development of the entire exchange is in the direction of giving the very best kind of service to all subscribers.

Directors were re-elected as follows: John M. Clark and Byron L. Smith succeeding the late Henry B. Stone and George M. Pullman, J. Russell Jones, John M. Clark, Norman Williams, Robert T. Lincoln, John de Koven, Byron L. Smith, Arthur G. Fuller, C. E. Perkins, William A. Jackson.

CENTRAL UNION TELEPHONE COMPANY.

President W. A. Jackson's report to the stockholders is as follows:

The following are the comparative figures of the financial transactions of the company for the years 1897 and 1896:

	1897.	1896.
Gross earnings	[illegible]	[illegible]
Expenses: For administration, operating, maintenance and interest	[illegible]	[illegible]
Net revenue	[illegible]	[illegible]
Surplus	[illegible]	[illegible]
Added to construction account		
At exchanges	[illegible]	[illegible]
For toll lines	[illegible]	[illegible]
Total	[illegible]	[illegible]

For the six months from January 1, to June 30, 1896, there was received in gross revenue $67,213.10 from property operated in the state of Iowa, and a net revenue of $26,148.37; therefore, to make the comparison of earnings and expenditures for the years 1897 and 1896 upon an equal basis, the Iowa earnings, as above, should be eliminated, since we have received no revenue from that source in 1897. The actual difference in favor of 1897, upon this basis, is:

Increase of gross earnings	$171,029.62
Increase of net earnings	65,332.10

The number of exchanges in operation this year is 153, an increase of 20; the number of subscribers December 31, 1897, was 36,318, an increase of 4,674; the number of toll-stations is 1,157, an increase of 202; the number of miles of wire in inter-town lines is now 24,446. There has been constructed during the year, in this class of property, 2,298 miles of pole line and 9,352 miles of wire, almost the entire amount of which is of copper metallic circuit. This practically completes the backbone and ribwork of a modern intercommunicating system between cities and towns. On account of the completion of these lines late in the season, the benefits of their increased earning power have not been realized in the year just past.

There yet remains, however, much development to be made in branch lines and spurs, as well as considerable reconstruction of old lines into modern, as strengthening features to the larger centers, the whole leading up to a comprehensive and universal system by means of these intercommunicating lines.

The work of remodeling the Indianapolis exchange is now complete, and it is in all respects the most modern plant of its class in the country, embracing many improvements not heretofore known to the art. In addition to this many improvements have been made at other exchange points, to care and provide for the growth of the business, as well as to add to the facility and completeness of operation. The cost of these improvements is as shown in the financial exhibit. There still remains to be done some important and comprehensive work of this class, in two or three important cities, in the very near future, provisions and plans for which are now being prepared.

The directors of the company are C. H. Brownell, R. C. Clowry, Arthur G. Fuller, F. H. Griggs, John E. Hudson, W. A. Jackson, J. Russell Jones, M. G. Kellogg, Robert T. Lincoln, John F. Wallick and Norman Williams.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The matter of a local telephone company is being talked of in Lisbon, N. D. The present system is owned by Dr. Bradley of Forman, N. D.

The Eureka Telephone company of Eureka, S. D., has been incorporated with F. W. Boetcher, C. N. Herried, E. G. Kennedy, William Poehler and Joseph Guhin as stockholders.

J. L. Ball of Augusta, Wis., offers to put in an exchange in that city if 50 subscribers can be secured. There is a small system, without a central exchange, now in operation by Mr. Ball.

The Winona Telephone company of Winona, Minn., has increased its switchboard facilities and now can accommodate 600 instruments.

The Ashland, Wis., office of the Wisconsin Telephone company reports an average of between 1,600 and 1,700 calls per day.

J. W. Johnstone, manager of the La Crosse Telephone company of La Crosse, Wis., has resigned. He will be succeeded by George R. Johnston of Chicago.

The new telephone exchange of Sparta, Wis., has begun operations.

P. T. Butler of Butte, Mont., has been placed in charge of the new telephone system in Lewistown, Mont.

A lively war of rates is on at Des Moines, Ia., and cut follows cut. The Mutual Telephone company has recently got its exchange in operation, and the Iowa company at once reduced rates. It now offers party-line service for $12 per year. Where subscribers order out an instrument it is requested to be left for a while to compare the service with that of the new company, without charge. The new company meets this by having its men offer to take down the Iowa company's instruments when putting in theirs, if the subscriber wishes. As a result it has taken down a number of the Iowa company's telephones.

A local telephone company is proposed in Litchfield, Minn.

The Iowa Telephone company offers to put in an exchange at Nevada, Ia.

The Fairmont Telephone company of Fairmont, Minn., had a surplus of $1,124.56 at its annual meeting, held recently.

A stock company is proposed to construct a telephone line between Dell Rapids and Garretson, S. D.

The Northwestern Telephone Exchange company is preparing to extend its lines north from Little Falls, Minn., to Brainerd, Minn.

The Wisconsin Valley Telephone company expects to have 750 miles of telephone line in operation by January 20th. Work was begun on September 27th and has been pushed rapidly ever since. The company connects with all the independent telephone exchanges in Western Wisconsin. It recently published at Eau Claire, Wis., a list of the subscribers of the various independent companies which it connects with in that vicinity.

Bridge Building at Niagara Falls.

By Orrin E. Dunlap.

In recent years electricity and trolley lines have played an important part in the development of the Niagara region. On both sides of the gorge trolley roads run from the Falls down along the river until the principal scenic features are passed, and now it seems probable that connection will be made between these roads, and the means provided for passengers making the trip around the gorge from Niagara Falls to Lewiston, across the river to Queenston, Ont., and up the Canadian side to the Falls on the return. The possibility of this delightful trip is to be effected by the construction of two great bridges to span the chasm. One of these bridges will be a new steel arch to be located on the site of the present upper suspension bridge, while the other will be built across the river between Queenston, Ont., and Lewiston, by the removal of the suspension bridge to that site and there rebuilding it. This will, of course, require considerable outlay, but the necessary capital has been provided, and the work has been commenced.

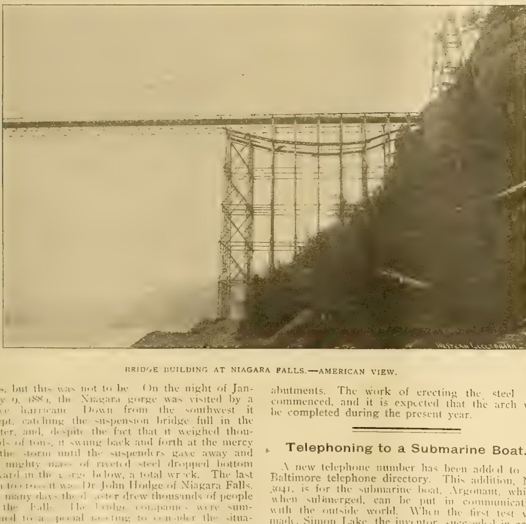
The new steel arch that is to be built will be the greatest bridge of its kind in the world, and is destined to prove an additional attraction to visitors at Niagara. The suspension bridge that is to give way in order that this more modern structure may be erected is one of the famous bridges across the gorge. The first bridge at this point was opened early in 1869. It was an all-wood structure 10 feet wide, which, in 1887-88, was rebuilt in steel, the width being increased to 17½ feet. This latter structure was finished in December, 1888, and the bridge companies felt that they had erected a structure that would outlast the lives of their members, but this was not to be. On the night of January 9, 1889, the Niagara gorge was visited by a fierce hurricane. Down from the southwest it swept, catching the suspension bridge full in the center, and, despite the fact that it weighed thousands of tons, it swung back and forth at the mercy of the storm until the suspenders gave away and the mighty mass of riveted steel dropped bottom upward in the gorge below, a total wreck. The last man to cross it was Dr. John Hodge of Niagara Falls. For many days the disaster drew thousands of people to the Falls. The bridge companies were summoned to a special meeting to consider the situation. They resolved to rebuild. Contracts were let, and in [illegible] days the new suspension bridge was opened to traffic. It is the bridge, only a few years old, that is now to be replaced by the arch. Thus the arch will be the fourth bridge erected on the site.

At the point where the arch is to stand the cliffs are further apart than at any other point between the Falls and Lewiston, the distance between them being 1,268 feet, and it is this space the new bridge is to occupy. The main span of arch in the bridge will be 868 feet long and will be connected to the cliffs by two arms, one of which will be 210 feet long, the other 190 feet. Its rise from the abutments will be about [illegible] feet. The abutments stand close to the water's edge. They are four in number, two on each side of the river, and were built in 1895, it having been expected to build the bridge long before this. In building the abutments care was taken to have them [illegible] and well fitted to withstand the heavy [illegible] that will be placed on them. A solid rock foundation was found, and on this a concrete foundation was built. On the concrete masonry was [illegible] stone used being very large and the mass being given additional strength by eight iron rods in each abutment.

In width the arch will be about [illegible] feet. In the middle of the floor about 23 feet will be devoted to two trolley tracks, and on each side of the tracks will be a roadway for carriages, each about eight feet wide, and outside of these will be walks or footpaths, raised a little above the roadway. The bridge will be a single-deck structure. It was designed by L. L. Buck of New York. Perhaps a better idea of the greatness of this new arch will be gained by comparing its dimensions with those of other great all-metal arches of the world, presented in the following table:

	Span.	Rise.
Louis I., Oporto, Portugal	566	146
Garabit, France	543	170
Grand Trunk, Niagara	550	114
Pia Maria, Portugal	525	121
Eads' St. Louis bridge	520	47
Washington bridge, New York	510	91.7
Paderno, Italy	492	123
Rochester Driving Park	423	67

Naturally the erection of a bridge of the size of the new arch is a feat of no small magnitude, and in order to facilitate the work the suspension bridge will be left in place until the arch is completed. It would be impossible to erect false work to support the entire arch, and so the suspension bridge will be a really important aid in building the arch. On it the great movable derricks will be erected to carry and place the iron where wanted, but traffic on the suspension bridge will not be interrupted by the work. On completion of the arch the suspension bridge will be removed and carried down stream seven miles to the site of reerection, where it will replace the suspension bridge destroyed by wind on April 16, 1864. The false work for the erection of the arch is all in place on both sides of the river between the cliffs and the abutments. The work of erecting the steel has commenced, and it is expected that the arch will be completed during the present year.



BRIDGE BUILDING AT NIAGARA FALLS.—AMERICAN VIEW.

Telephoning to a Submarine Boat.

A new telephone number has been added to the Baltimore telephone directory. This addition, No. 3041, is for the submarine boat, Argonaut, which, when submerged, can be put in communication with the outside world. When the first test was made, Simon Lake, the inventor, succeeded in communicating with people in Baltimore and Washington. The telephone was placed in the office of the Lake Submarine company, whence a wire was run on board the Argonaut. Shortly after noon the boat was submerged, and Mr. Lake, from the bottom of the harbor, proceeded to make himself heard. He first called up the office and received a quick and clear response. He then rang off and called up people at greater distances, finally ending by communicating with the superintendent of the telephone station at Washington. The test was satisfactory in every respect, and marked a new era in the history and usefulness of the Argonaut. The arrangements are as unique as they are complete. The wire, which is on a reel, is encased in water-tight tubes, and can be extended for several miles, if necessary. Mr. Lake is now arranging to make some tests in raising wrecks in the vicinity. He will endeavor to raise the [illegible] Express, which is said to have sunk off the Potomac River some fifteen or eighteen years ago.

W. R. Fahen, the receiver of the Defiance (O.) Light and Railway company, has been ordered by the court to sell, if possible, the street railway property in his charge.

The Relations between the Customer, Consulting Engineer and the Electrical Manufacturer.[1]

By S. Dana Greene.

Part I.

The subject which I have chosen for this paper is an eminently practical one, and I shall endeavor in my remarks to call attention to certain causes of friction which at present exist between the parties in interest, and to suggest certain remedies which may serve to bring about a better understanding and to lessen this friction, which is, in my opinion, entirely unnecessary.

In order to discuss intelligently present conditions, it is advisable to trace briefly the development of the electrical business, and to do this one need hardly go back more than a dozen years. At that time electric lighting was still an experiment (from the commercial standpoint), electric railroading had not begun and electric power transmission was discussed as one of the possibilities of the future. Very few of our institutions of learning had established separate electrical courses, and such a thing as a consulting electrical engineer hardly existed in this country. The few men who had some theoretical knowledge were eagerly caught up by the manufacturing companies, who had difficulty to find men capable of solving the many pressing practical problems with which they were confronted when they began to sell electric machinery. Thus the development of a practical generator and incandescent lamp immediately created a demand for suitable conductors and materials for outside and inside wiring, safety devices, etc., as well as close regulating engines, proper station appliances and many other things which are to-day regarded as "standards" in the business. It was less than a dozen years ago that the first fireproof switchboard was installed in the Broadway Theater. The specifications were drawn by a consulting engineer—a naval officer by the way—calling for a fireproof structure, and the manufacturer no doubt accepted the order thinking that he could use what had always been used before, viz., a wooden framework. In this he was mistaken, however, and after a year's wrangling a slate board was installed, much to the manufacturer's disgust, and at great expense to him. It is hardly necessary to say that this form of switchboard became standard immediately, and several years after, the manufacturer, happening to meet the naval officer, said to him, "Someone was a d——d fool about that switchboard, and you were not the man." I well remember when I left the navy to join the Sprague company in June, 1887, I found that the technical force of the company consisted of Mr. Sprague, an ex-naval officer, and Lieut. Crosby, who had just left the army. Upon explaining to the former how modest was my store of knowledge on the subject of "electric street railways," he at once assured me by saying that we were all in about the same boat, and that there was a fine opportunity to learn! My opportunity came sooner than I expected when, about July 1st, I was charged with the execution of a contract for the equipment of a 40-car road in Richmond, Va., which, under the terms of the contract, was to be in full and complete operation on the first of the following October.

Doubtless most of those present to-night can recall the remarkable growth of electric lighting and railway work, during the next five years, from 1887 to 1892, a growth that can fairly be called tropical. Plants sprang up in nearly every city and town in the country, and manufacturers sprang up with equal rapidity. There seemed to be unlimited money ready to invest in electrical enterprises, and the anticipated profits were such as to make the old established manufacturing industries seem very poor investments. During this period, which may be called the "forced expansion period," purchasers usually had to take what they could get and consulting engineers were few and far between. Specifications for apparatus or installations when there were any, were generally prepared by the manufacturer, and the purchaser rarely knew whether they had been fulfilled or not. By the close of this period, however, the colleges and technical schools began to turn out men who had taken special courses in electricity and who naturally looked for a chance to make an honest living. The first great demand of the manufacturing companies for technical assistants having been satisfied, many of these young men found their way into local operating companies, or else established themselves as consulting or contracting engineers, in which positions they found plenty of work, for by this time the imperfection in the earlier installations and types of apparatus had become plainly evident to the purchaser as well as to the manufacturer, and there was a general demand for better workmanship and more rigid requirements in installation. It may be here noted that much of the "anticipated profit" of the business, both of the operating and manufacturing companies, was spent subsequently in making good these early defects, and while the business as a whole profited largely by this reconstruction process, it naturally dampened the enthusiasm of the early investors.

In 1893 came the panic, and for the past four years there has been a wonderful record of savings

1. Read before the New York Electrical society, January 21 1898.

and economies, both in electrical manufacturing and operating companies, as well as a great improvement in quality of product. It has been, in fact, the "economic and reconstruction period." The operating companies have learned that they, too, are manufacturers of a product, electricity; and as these hard times have forced down the price of their product, they, like the manufacturers of apparatus, have to keep their heads above water and their companies out of receivers' hands by the introduction of more economical and improved methods of manufacture and of administration. During the past year there has been a marked improvement in the electrical business; it is to be hoped that this improvement is permanent, and that the past four years of retrenchment and economy have paved the way for a normal and steady growth on conservative lines—in other words, for a period of "natural expansion." The business to-day is on much the same basis as in other industries, where prices are close, competition keen, and where a better article is furnished for less money than ever before.

The manufacturers of apparatus and the manufacturers of current are dependent upon each other to a large extent, and their relations should be close and friendly. The consulting engineer, as in other engineering trades, is a necessary and proper connecting link between the two, and I can say frankly that I believe he has a proper and permanent field of usefulness. Broadly speaking, his function is to see that his client who buys apparatus and installs it selects first that system best suited to his particular local conditions, and then, in purchasing, secures the best (not necessarily the most) for his money. It is equally the duty of the consulting engineer to learn what the manufacturer can reasonably be

BRIDGE BUILDING AT NIAGARA FALLS CANADIAN VIEW.

called upon to make, to consult with him freely and to obtain the benefit of his experience; to give him credit for work well done, and to insist that bad work shall be promptly corrected. Many consulting engineers, especially those who have recently commenced practice, seem to think that it is improper for them to consult with the manufacturer or to examine his plant, or to ask him for information or advice. Their idea seems to be that, by so doing, they may be accused of partiality or undue bias, or with lack of proper care for the interests of the purchaser; or they may feel that it is derogatory to their own dignity as independent engineers. The inevitable result is that specifications often contain provisions which are a source of annoyance and expense to the manufacturer and purchaser alike, and which have no compensating advantages from either the engineering or commercial standpoint. In fact, some of these provisions are impossible or impracticable of fulfillment, and in such cases the honest manufacturer who wishes to meet the specifications and guarantees required finds himself forced to ask the engineer or the purchaser (sometimes both) to modify them. This is a proceeding which is always difficult and delicate to undertake, and often results in friction and trouble for all concerned. I am satisfied that if every consulting engineer would take advantage of opportunities as they occur, to visit manufacturing establishments, see the work there in progress and confer with the engineers, he would find himself well repaid for the visit, and his own work and practice benefited thereby. I am equally satisfied that no reputable manufacturing establishment would refuse admittance, but on the contrary would welcome such visits as beneficial to both parties. The day of mysterious methods of manufacture, carried on behind closed doors, is passed in the electrical business, and I appeal with confidence for an indorsement of the opinion just expressed, to those consulting engineers who have already tried the plan suggested. I have said that I thought the engineer would find himself repaid by such visits. I think, also, that he will find himself in a better position to advise his client intelligently. A purchaser usually knows little or nothing of the relative technical merits of apparatus, and his final decision is governed largely by price and by paper statements and guarantees, which may mean much or little. The consulting engineer who has seen the apparatus in process of manufacture can advise not only as to whether the various bids comply with the specifications, but also what make or makes of apparatus are, from their design, construction and factory inspection and test, most likely to give the least trouble and expense in continuous service.

Some engineers seem to measure their value to the purchaser by the length of their specifications, and some of these formidable documents strike terror to the heart of a busy man confronted by a desk full of mail. The specifications not only specify what the conditions of service are, what apparatus is required and what tests shall be applied to it for acceptance, all of which are quite proper, but also how it shall be built, which is another matter. The electrical manufacturers of this country, following the admirable precedent which has given American manufactured products (particularly machinery) a world-wide reputation, have endeavored to establish standard lines of apparatus, whenever the permanency of type and the size of the demand warrant it. This practice not only tends to reduce cost (and with it price), but also enables the purchaser to secure quickly and at a minimum of expense duplicate parts which are really duplicates and which can be fitted without the aid of a skilled mechanic. It is the American system of standard lines of machinery and interchangeability of parts, which has stood the test of time and which holds its own against all competitors. This system, however, is possible only where the same article is manufactured in quantity, since the expense of designs, drawings and patterns, special tools, jigs, dies, etc., is prohibitive unless spread over a large production. On the other hand, if special apparatus is required it means a relatively large expense for these items, which cannot be charged to a standard product, and which thus constitutes a handicap both to the manufacturer and the purchaser. A machine is "standardized" only after long experience, both in manufacture and service, and other manufacturers (the builders of engines, trucks, etc.) as well as the users, are invariably consulted before such standardization. It would appear to be to the interest of both seller and buyer to use such standard machines wherever and whenever possible; and yet it seems to be a fact that the demand for special machines is increasing, rather than decreasing, as apparatus becomes more generally standardized. To prove this I can cite the experience for the past year of one manufacturing company, with which I am familiar. During this period, the designing engineers were called upon for estimates on special apparatus as follows:

Direct current:
- Number of estimates 300
- Number of kilowatts of apparatus involved 31,000

Alternating current:
- Number of estimates 300
- Number of kilowatts of apparatus involved 131,200

These estimates were all embodied in formal propositions. Besides these there were between two and three times as many preliminary estimates required to answer inquiries of customers, which the engineers had to prepare.

This was in addition to their regular work on standard lines of apparatus, of which there are over thirty. Some of this work was undoubtedly due to new developments in the business and to new methods and inventions, a condition which, although unfortunate from the manufacturing standpoint, must exist for many years to come; but a great deal of it was also due to the fact that specifications call for special apparatus, or methods of construction, where standard apparatus and methods would do equally well. This experience I find is common among electrical manufacturers, and I attribute it largely to lack of touch between the manufacturer and the engineer drawing the specifications, whether he be regularly employed by the purchaser, or retained in an advisory capacity. Let the engineer see more of the manufacturer and his work and let him hold the latter responsible for results, as determined by proper tests, leaving the details of construction where they belong, in the manufacturer's hands.

Armour Institute of Technology.

William H. Merrill, Jr., electrician for the National Board of Fire Underwriters, delivered a lecture on "Electrical Fire Hazards" to the students of Armour Institute of Technology on January 18th. He divided the fire risks into eight classes, as follows:

I. Crosses between aerial wires of different systems.

II. Grounds and short-circuits on electric light and power systems.

III. Wooden-based devices.

IV. Transformer breakdowns.

V. Sparks from arc lamps.

VI. Poor contacts and connections.

VII. Heating effects of incandescent lamps.

VIII. Miscellaneous troubles from (a) cut-outs, (b) switches, (c) rheostats, (d) motors and dynamos.

He recommended that transmission circuits, and even isolated plants, especially where the conductors pass from one building to another near by, should be put in underground conduits, unless there are good economic reasons for overhead construction. If this practice becomes general, he maintained, fires of electrical origin will be much less numerous than at present, and a great many troubles which are destructive to apparatus will be avoided. He emphasized the danger of loose contacts, joints or connections when placed near inflammable substances, such as wood or fiber insulation.

These remarks were strikingly illustrated by numerous examples which had been collected by the inspectors. The necessity for some adequate earthing device to protect the secondary of the transformer from the primary electromotive force was pointed out, and certain recent pieces of apparatus to accomplish this were described. He believed that the attempt to prevent the primary from short-circuiting with the secondary could not be entirely accomplished by increasing the thickness and character of the insulation. The fire hazard with transformers is very great when high electromotive forces accidentally get in the primary coil. In one instance, lightning burned through to the secondary and punctured the gaspipe in four or five chandeliers just at the insulating joint, and ignited the escaping gas, thus starting four or five simultaneous fires in the house.

Universal Exposition at London, Eng.

Electrical manufacturers in this country may be interested in the announcement that a Universal Exposition will be held from May to October, this year, at Earl's Court, London.

The exposition will be under the director-generalship of Imre Kiralfy, of New York and Chicago fame, and it is intended to illustrate the latest achievements in inventions, manufactures, industries and applied arts.

Important sections will be devoted to the largest manufacturing and producing countries of the world, and, considering that it is over 12 years since an exposition of this kind was held in London, and judging from the ever-increasing development of American trade during this time, it is confidently expected that American producers and manufacturers will avail themselves of this opportunity to extend their business. Mr. Kiralfy says that the best location has been reserved to the United States department, and no pains will be spared by the management in order to afford every facility to American exhibitors.

Mr. A. Macchi, who was a member of the Board of Judges at the World's Columbian Exposition in Chicago and commissioner at the expositions at San Francisco and Atlanta and lately chief of the foreign department at the Tennessee Centennial Exposition, Nashville, 1897, has been appointed commissioner for the United States.

The Chicago City Railway company has asked the City Council for some extensions in Twenty-second and Thirty-fifth streets and in Center avenue. The ordinance covered the following named streets: In Twenty-second street, from Indiana avenue to South Park avenue, and in South Park avenue 200 feet south; in Thirty-fifth street, from Cottage Grove avenue to the Illinois Central tracks; in Center avenue, from Thirty-fifth street to Twenty-second street. The rate of fare is to be five cents, with transfers from all cross-town lines. Any operating power may be used except steam.

Western Electrician

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COPYRIGHT.—Not only the title but the *entire contents* of each number of the WESTERN ELECTRICIAN are copyrighted. This paper is entered at the Chicago postoffice as mail matter of the second class.

SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year, single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN — **the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 20,000.

State of Illinois, County of Cook—ss

Frank Foster Kenworthy being duly sworn deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the superintendent of the binding department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the binding of No. 24 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were sent out by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified.

And further this affiant sayeth not.

FRANK FOSTER KENWORTHY.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES. Notary Public.

Four Years' Record of Electric Light Convention Advertising.

Issue	Number of Advertising Pages.	Whole Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895	52	68	5,593
May 9, 1896.. ...	72	88	7,575
June 12, 1897	80	100	8,643

No other electrical journal has ever equaled this record of 8,643 square inches of genuine full-paid advertising in a single issue.

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Considerable space is devoted in this issue to the proceedings of the Milwaukee meeting of the Northwestern Electrical association. The organization continues to attract attention and win the support of the fraternity throughout the Northwest. The list of new members admitted at Milwaukee is an excellent indication of the growing power of this association.

The American Street Railway association is already preparing for the annual meeting of that organization in Boston. There will be a meeting of the executive committee next Tuesday, at which the plans proposed by the local street-railway men will be considered. It is believed that all the preliminary arrangements will be made at that meeting and decision reached upon the principal features of the programme for the coming meeting.

During the last few weeks the publisher of an eastern electrical paper has been circulating among electrical advertisers a fac-simile letter purporting to be addressed to him by an electrical manufacturing company, in which serious reflections are cast upon the merits of the other electrical publications of the country. The letter is false and malicious in every respect, and was inspired by the publisher in whose interest the electrical company appears to act as a tool, judging from the form and contents of the communication. It is unnecessary to mention by name the publisher who is responsible for this dirty work; there is only one who is capable of resorting to such methods.

We also forbear mentioning the name of the company for the present, in the hope that it may furnish some explanation of its action.

An English weekly journal predicts that some day there will be a terrible fire on one of the great Atlantic liners from the unprotected flame of a spirit lamp used to heat curling-irons. Curling one's hair in one's cabin is against the rules of every passenger ship. The rule is an unwritten one, to be sure, but it is understood. Every ship's captain will say that all passengers understand that under no consideration are matches or spirt-lamps to be used in the cabins. The reason of this rule is not hard to find—a preventive of the dangers of a fire at sea. But the ladies—or many of them—feel that they really must curl their hair, and pack spirit-lamps, methylated spirit, curling-tongs and matches in their steamer trunks. It is feared that some day one of these lamps will topple over when the ship gives a lurch and that a disastrous fire may result. The suggested prevention of this calamity is the provision of electric curling-iron heaters in every stateroom of the ship.

Some interesting points about the common use of poles sustaining electric wires were raised and decided in a recent case in Connecticut. It was decided that it is not unlawful for a telephone company and an electric railroad company to use the same poles, when such joint use is with the consent of both companies, and at the request of the municipal authorities, especially where full control of the location of the wires and structures is given to the local authorities by statute. The decision was made by the Supreme Court of Errors of Connecticut, in the case of Bergin against the Southern New England Telephone company and the Meriden Electric Railroad company. Where there is such joint use of poles, the court says, there is no absolute requirement of law imposing upon the telephone company the duty, to its linemen, of inspecting and testing the guy wires or the circuit breakers of the electric railroad company. Whether the employer or the employe should discharge such duty, [illegible] must depend upon the circumstances of each particular case. In many instances, the [illegible] state, either may properly perform that work, and in some cases who should perform that [illegible] question of fact, to be determined by a [illegible] of circumstances, such as the nature of the [illegible] inspection, the skill, opportunity and [illegible] the workmen to properly do it, and the [illegible] the contract of employment.

The evidence in this case showed that when, in the performance of the work in which they [illegible] it became necessary to handle [illegible] of the electric railroad company, or when a contact [illegible] such wire was likely to occur, the duty devolved upon the employes of the telephone company, and not upon that company, to first ascertain whether such wire was charged with electricity. As against the telephone company, therefore, the court holds that a lineman's negligent failure to make needed tests to know the unsafe condition of a guy or span wire of the railroad company using the same poles must defeat a recovery for an injury caused by such failure. But as against the railroad company, not being its employe, the court says that he is under no contract duty to test its wires or circuit breakers, and may, under some circumstances, assume that it is performing its duty, and using suitable and safe appliances to prevent the escape of electricity from the main or trolley wire to the guy wires. Yet the latter will be liable for an injury caused by its negligence only to one who was himself in the exercise of ordinary care.

Alas, we are discovered! Starting to do up our hated trade rivals, we Americans are ourselves undone. We might have known it; the conservatives told us that the scheme could never escape the Argus eyes, the serene intelligence, of the English technical press; but a hot-headed administration knew no pause. It was the golden opportunity—the tide that, taken at the flood (which we were to artfully augment), would lead us on to fortune and overwhelm the purse-proud Briton. And what has been the result? Miserable failure—nothing less. One clear, clarion note has been tooted by the Electrical Review of London, and all the fat is in the fire. "Men of the Amalgamated Society of Engineers," demands our contemporary, with impressive eloquence, "have you positively ascertained that among the agitators who are goading you on to your doom there is not one who is in the pay of Germany or America?" After that, further attempt at concealment would be worse than folly. The question so skillfully pressed home is an accusation, and denial is useless. The jig is up; the scheme has aborted; let us recall our agitators and cry quits. The English can conduct their own strikes in the future.

In spite of hard times, some of the electrical enterprises that find it necessary at this time to seek additional capital make an excellent showing. The Central Union Telephone company of Chicago and the United Traction company of Pittsburg are notable examples. Both invite the attention of investors to their securities, and the figures they present would seem to indicate that the earning capacity of this class of investments has not been seriously affected.

The Central Union statement places the earnings of the last year, after deducting all charges except interest on bonds, at $340,787. This is considered a remarkably good showing in view of the expenditures for extensions and maintenance. After deducting the annual interest charge upon all bonds outstanding, including the new issue, which will now amount to $150,000 a year, a dividend of about 4-5 per cent. might be declared. The earnings of stock in 1896 amounted to 3½ per cent., but interest charges then were less than half the present interest obligations. During the five years ended December 21, 1896, the net earnings of the company amounted to $1,533,923, an average of $306,784 per year, and net earnings for 1897 were, therefore, $34,000 greater than the five years' average. This excellent condition is particularly noteworthy at this time because of the competition which has developed in the Central Union company's terrritory.

The United Traction company of Pittsburg is a consolidation of the principal street railway lines of Pittsburg and Allegheny, and this property, it is claimed, earned in 12 months, during seven of which the roads were operated under separate managements, more than enough to pay the interest on all obligations then outstanding and also full dividends on the preferred stock. For the five months ended November 30, 1897, for which period the United Traction company has been operating the properties, the surplus earned over full dividends on preferred stock for six months was $28,-270.85.

It is really gratifying to note these instances, and it is to be hoped that the new year will mark the beginning of a period of general prosperity throughout the country.

Northwestern Electrical Association.

Favored by excellent weather, the Northwestern Electrical association began its sixth annual meeting at the Hotel Pfister, Milwaukee, on Wednesday, January 19th. The sessions continued during three days, the attendance being the largest in the history of the association. There were several very interesting displays of electrical apparatus in the parlors of the hotel, and several new devices were shown for the first time at this meeting.

The opening session was occupied principally with the reading of the president's address, the report of the secretary and treasurer and the election of new members. It is worthy of mention that the number of applications for membership which were received this year was far in excess of the number received at any previous meeting.

In the afternoon there was an interesting discussion of the law affecting the taxation of electrical corporations in Wisconsin. A good deal of opposition was manifested to the present arrangement, which requires the payment of a certain percentage of the gross receipts of the companies. Many of and members favored a return to the old method by which the assessments were levied by local assessors. The corporations in the large towns, especially the Milwaukee Street Railway and Lighting company, had advocated the enactment of the present law, giving as a reason their reluctance to submit such an important question to the city assessors of Milwaukee. This corporation claimed that the prejudice against it was so strong in Milwaukee that it could not submit its interests to the local board of assessors at that time. Many of the representatives of smaller companies contended that this was a short-sighted policy, as the tendency of the Legislature would be toward increasing the rate of taxation from year to year. It was pointed out that the experience of the water companies of the state warranted this conclusion. No final disposition was made of the matter, however, and one member, in commenting upon the situation, exclaimed: "Thank God, there will be no Legislature this year!" Another subject that occupied a good deal of attention at the same meeting was the discussion of the time and place for holding the midsummer convention. These discussions occupied considerable time, but the convention finally got down to business late on Wednesday afternoon, and Alex Dow of Detoit presented a paper on "Electric Lighting for Profit." There was no general discussion of this paper.

Mr. Dow was invited to open a discussion upon the subject of "Municipal Lighting." He gave a history of the troubles of the city of Detroit, which finally culminated in the establishment of a city lighting plant, and presented considerable data upon the cost of construction, operation and maintenance of this plant. The convention decided not to give out Mr. Dow's address for publication, but it may be stated that while he asserted that he believed the city of Detroit was justified in establishing a municipal plant, and in fact, as he put it, "was forced into doing so by the action of local lighting companies," he was not prepared to advocate municipal ownership generally. On the contrary, his address indicated a sympathy with the idea of central stations furnishing public lighting by contract.

A detailed account of the proceedings, prepared from the official stenographer's report, is appended:

Convention Proceedings.

The sixth annual convention of the Northwestern Electrical association was called to order January 19th, at 11 a. m., by the president, H. C. Higgins of Marinette, Wis., and after the roll had been called by the secretary, and the minutes of the last convention accepted as printed, the president read his address, in which he said:

I am pleased indeed to see so many of you present. It bespeaks a good convention, and as president of this association I thank you for your presence here to-day. I see that the supply man, God bless him, is quite in evidence, for which I am also thankful, for I think him the saving clause of this association. I do not know what we would do without him, and I believe in electing him to full membership.

I am a believer in associations and frequent conventions, the more frequent the better. I trust that you have come to this convention to talk as well as to listen, and give us all the benefit of your experiences in the business. I am glad to be able to state that but one death has occurred in our ranks during the year, and no company which is represented in this association has gone into the hands of a receiver except one, and that only temporarily. There has been no state legislation enacted that I consider particularly offensive to our business, and so far as I can learn, the committees appointed at our last January meeting have done their work well.

I see before me many men who have been in the central-station electric light business for years, some of them having grown gray in it, and I do not know of more than one or two instances where they have realized one dollar on their many years' investment, still the public thinks we have too many privileges and are getting rich through the business. To be sure, those who went into the business in its early days had much to contend with. We have learned something about the business and can now get more efficient help than formerly, and at reduced wages; our supplies are much cheaper, and although we have all reduced our prices for light, I am sure we are all doing better in a financial way than we were in the early history of the business. When we first went into the electric light business we paid $25 a thousand for carbons, a dollar apiece for incandescent lamps, 70 cents for sockets, and all other supplies necessary for the business at correspondingly high prices, so that I think if we are let alone our business will be fairly remunerative for some time to come. The electric wattmeter has been an excellent thing for us, and I hope the time is near at hand when electric current will be sold only by meter.

One dangerous element that we have to look out for is the political schemer who is always working for the dear people; and the gas and electric light companies seem to invite his particular attention. You may ask me for a receipt of treatment of him, but I must answer that I have none other than to meet him with good work and honest facts. Give the public good service and fair prices and courteous treatment and the battle is won.

The gas business will speak for itself, and, like the poor, will always be with us. We who were in the gas business, when the electric light business was first introduced, remember well how fearful we were lest the new light should send us out of business; yet gas interests and securities stand higher in the financial market of the country than was ever known before electrical lighting was introduced, and as yet neither industry has hurt, but rather helped the other.

I wish it to be understood that my remarks on street-railway matters shall apply principally to street railways of the smaller class, in towns of from 10,000 to 15,000 population. The street-railway business has, I think, suffered more within the last two years than any other legitimate business. Not only has the hard times worked against it, but the bicycles have taken a large percentage of the business. The new woman and many of the old ones have hied themselves away from us on their wheels, and both have had plenty of followers. They have quit us cold, but it is to be hoped that they will soon return in a changed temperament, for as repair bills for broken bicycles are met with and the many various disappointments which surround wheeling have become unbearable to them, it is to be hoped that they will return and give up their nickels to the electric car even more willingly than they have ever done before.

It is gratifying, however, to street-car men to know that the expenses of operating, as well as those of original purchase, have been very much reduced. The reduced receipts have had much to do with the reduction in operating expenses, so that perhaps after all the reduced receipts have been a blessing in disguise. I think that no business has ever been launched that has been more disappointing to those putting their time and money into it than has been electric lighting and electric street railroading, especially in their early history. The man who was running a horse-car or a mule-car line would go to a town where they were running the new electric street railway; he would see the beautiful cars with every seat occupied by a passenger, gliding over the track without any apparent effort and at a more rapid rate than he had ever hoped to accomplish on his line, a uniformed conductor on one end, a uniformed motorman on the other, with everything bright and shiny. It was a beautiful sight to him, and frequently he did not go home until he first visited the office of Mr. Beggs or Mr. Sunny, whose bright, smiling countenances were only a continuation of the bright things he had seen in the electrical equipment at the last town which he had visited, and got prices from each of these gentlemen for electrically equipping his road at once. He went home, consulted his board of directors the first day, explained what he had seen and some of the things he had felt, and that night sent a message accepting the proposition of one of the contestants before mentioned; the next day a meeting of the council would be called, his franchise changed from horse to electric, and he could not get his stuff quick enough in his mad desire to be the manager of an electric street railway such as he had just seen. We all thought in those days that about all that was necessary was to secure a favorable franchise and the electric manufacturing companies would do the rest, but I know of nothing that so fittingly applies to the case as the following from one of Moore's poems:

> I saw from the beach when the morning was shining,
> A bark o'er the waters move gracefully on,
> And I saw from that beach when the eve was declining,
> The bark was still there, but the waters were gone.

The nickels which we have expected to have supported our enterprise had, like the waters, gone, and left our bark, the street railway, stranded.

It is not to be wondered that after five or six years of experiments in the business and with improved appliances, more efficient help, etc., we can reduce the operating expenses. We can buy our repair parts for one half what we could in the early history of the business and our equipments for one-third, and all better and more efficient than the first. Every appliance in the business has been an improvement on those that went before, and we have all contributed something toward this result, until the business has now become one of comparative pleasure to that which it was in its early history, when we were trying to operate an electric road on a horse-car track with inexperienced help, who, notwithstanding their incompetency, were high-priced and indifferent, for, if they were not retained by you, they were pretty sure of a job at the next town having a similar business. Our rail bonds were continually breaking, our track continually spreading and letting our cars drop to the ground, and no matter how well it was cared for, the track was a constant annoyance. Our commutators were niggering and our motors short-circuiting, and on our very busy days these things seemed to combine to do their worst to make us miserable. Our days were restless and our nights sleepless, but by patience and persistence we have become masters of the situation, and I think if the writer was alive to-day who wrote "He who makes two blades of grass grow where but one grew before is a benefactor," he would add, "And he who carries two passengers where but one was carried before is also a benefactor." We certainly have done more for the public than we have for ourselves and our associates in the building up of these electric street railways.

And now in my closing remarks in relation to electric street railroading, while congratulating ourselves upon the pleasant side of the business, I would ask how long the restless brain or the genius of the nineteenth century, or even the twentieth century, will let us alone. How long will it be before they will have something better to offer us for transporting passengers than an electric street railway? We are already threatened with the airship and the horseless carriage. What will be accomplished in these lines is mere guesswork. Let us hope, however, that at least we who are in the business to-day will get a much needed rest from any further experiments.

Secretary and Treasurer's Report.

Mr. Mercein read the following report, which was adopted:

In July last, as per my report to the convention of that date, our financial condition was as follows:

Assets.

Uncollected dues and fees	$245.00
July dues	240 00
Cash on hand	137 50
Uncollected advertising accounts	30 00
Office furniture, etc	40 00
Central-station pamphlets on hand, cost	60 00
Badges, cost	6.08
	$758.58

Liabilities.

Central-station pamphlets	$102 00
Balance Lord account	59.50
Sundry accounts	51.94
Credit balance	545.14
	$758.58

Since then I have collected from—

Membership fees	$190 00
Dues	135 00
Advertisements in July report	147 00
Stenographic convention reports	120 00
Central-station pamphlets	13 50
	$605 50

And disbursed for—

Stenographers' account	$139.57
Central-station pamphlets	102 00
Traveling expense	82.10
Printing July report	76.00
Secretary's salary	75.00
P. Norcross' account	57.31
Sundry bills	29 69
Postage account	26.00
Office account and sundries	12.33
Western Passenger association	6 00
	$606.00

Our present financial condition is as follows:

Assets.

January dues now payable	$475 00
Delinquent dues and fees	255 00
Cash on hand	137 00
Central-station pamphlets on hand	16.50
Office furniture, etc.	40.00
Uncollected advertising accounts	21 00
Badges	6 08
	$950.58

Liabilities.

Balance Lord account	$ 51 50
Sundry bills	33 75
Credit balance	865 33
	$950.58

Carrying out the instructions of the July convention, I corresponded with the National Electric Light association concerning a possible joint action of the two associations on a municipal ownership report to the Bureau of Statistics at Washington. The matter is still pending. I am credibly informed that the National association proposes at its meeting in Chicago, next June, as one of its prominent features, a full discussion of municipal ownership, inviting prominent advocates of both sides of the question to make the convention their arena for debate. If this information be correct, the National association has seized an opportunity which the Northwestern had, but did not avail itself of, last spring. In this connection I would call attention to page 5 of my July report. I suggest the advisability of appointing a representative of this association to attend the National Association convention. As to central-station pamphlets, after giving the matter careful consideration, it having been left to my judgment, I decided that under the terms upon which the statistics were asked for and furnished we have not the moral right to advertise them for general sale and distribution. The pamphlets are on hand and for sale to members and contributing plants.

only. Five hundred reports of the July convention were printed and mailed to members and central-station plants in the Northwest. I found it necessary to visit Chicago several times, and secured a satisfactory amount of advertising for the report; also was able to renew my previous arrangements with electrical journals for stenographic reports of this convention's proceedings and papers at $20 per set. On December 23d and January 11th first and second notices respectively of this convention were mailed to all members and the electrical press. I have secured a one and one-third railroad rate conditioned upon 100 certificates of attendance, and a special agent of the Western Passenger association will be on hand to-morrow all day to countersign railroad certificates. I take pleasure in stating that I have on hand the largest number of ante-convention applications for membership in the history of the association. We are under obligations to J. M. Hill of Chicago for his activity in this respect; also to Frank L. Perry of Chicago for his service in transportation matters, and to William L. Church of Milwaukee for his valuable work in connection with hotel and exhibit arrangements.

Applications for Membership.

Following is a list of the individuals, firms and corporations that presented applications for membership and were admitted:

Westinghouse, Church, Kerr & Co., Chicago, Ill.
S. S. Neff, Chicago, Ill.
Bryan-Marsh company, New York.
H. L. Brintnall, Saginaw, Mich.
Fred N. Bossen, Calumet, Mich.
J. S. Porteous, Minneapolis, Minn.
National Switch and Signal company, Chicago.
Western Electric company, Chicago.
Electric Storage Battery company, Philadelphia.
Diamond Electric company, Peoria, Ill.
C. H. Wilmerding, Chicago.
Robert E. Richardson, Chicago, Ill.
Cedar Rapids Electric Light and Power company, Cedar Rapids, Ia.
William Chandler, Sault Ste. Marie, Mich.
W. F. Kingen, Sault Ste. Marie, Mich.
John H. Culvert, Decatur, Ill.
G. E. Yost, Portage, Ill.
E. L. Draffen, Chicago, Ill.
Thomas Duncan, Fort Wayne, Ind.
Kohler Bros., Chicago, Ill.
W. D. Chapman, Akron, O.
C. G. Guild, Fort Wayne, Ind.
M. B. Wheeler & Co., Grand Rapids, Mich.
Electrical Engineering company, Minneapolis.
Rohn & Meyer, Milwaukee.
O. G. Goodrich, Minneapolis, Minn.
F. D. Hack, Chicago.
F. B. Badt, Chicago.
J. S. Loomis, Sheboygan, Mich.
Baraboo Gas and Electric Light company, Baraboo, Wis.
Fred D. Nims, Muskegon, Mich.
Cloos Electrical Engineering company, Milwaukee.
Charles S. Kehler, Milwaukee, Wis.
E. D. Alexander, Chicago, Ill.
O. P. Kissel, Hartford, Wis.
H. O. Channon, Quincy, Ill.
Charles L. Burlingham, Chicago.
J. B. Morrill, Evanston, Ill.
E. G. Cowdery, Milwaukee.
A. S. Smith, Milwaukee.
C. G. Gilman, Milwaukee, Wis.
J. H. Andrews, Reed City, Mich.
I. D. H. Ralph, Owasco, Mich.
J. T. Foster, Racine, Wis.
B. J. Shockley, Decatur, Ill.

Several telegrams were received from absent members and read by the secretary.

Election of Officers.

When the afternoon session was called to order by the president, Mr. Bean moved that the chair appoint a committee of three to nominate officers and directors for the ensuing year. The motion was unanimously carried, and the president appointed as such committee W. W. Bean, H. L. Doherty and [illegible] Norcross. The following ticket was recommended by the committee and unanimously elected:

For president, F. A. Copeland of La Crosse, Wis.
For first vice president, [illegible] of Houghton, Mich.
For second vice president, P. H. Korst of Racine, Wis.
For secretary and treasurer, [illegible] Mercein of Milwaukee.
For directors, [illegible] of Sheboygan, Wis., chairman; George L. [illegible] of Belle Plaine, Iowa; S. B. Livermore of Winona, Minn.

The president appointed Messrs. [illegible], Bean and Davis as a committee to escort Mr. Copeland to the chair.

President Copeland said, on assuming the chair: "I thank you very much. It is an honor to which any member of this association should be proud to [illegible]. I wish to congratulate [illegible] on the time that has been kept [illegible] the acquisition of [illegible]. I have no doubt that if each member does his part we will [illegible] swallow up all the other [illegible]. I think that our association is really doing [illegible] good and [illegible] more benefit to the [illegible] in the light and power business and dealing with the public than some of these higher and more aristocratic institutions. We come next to the people, and I would like to impress upon the minds of all members the importance of inducing those that are engaged in any way in the electric-light business to become members of this association. We should convince those people who are not with us now that even if they are not in danger, there may be a time when they will need some help. It is characteristic of human nature to ignore the future when the present is safe, but when one gets into trouble the cry is 'Why don't you do something for us?' Get in line and get to work right on the start and help each other. As I understand the object of this association, it is not to antagonize the public or anything of that kind. We are in a legitimate business and we must teach those that we are dealing with that we are carrying on a legitimate business and will do the best we can, and that all we ask is a fair remuneration for our capital; we will either have that or we will quit.

"There is a good deal of work for each member of the association. A member should not sit down, keep still and let the rest do the work. Each has a certain duty to perform, and if everyone will do his duty, we will have one of the grandest organizations there is in the country; and it will be of vital interest for all those that are engaged in the same business that we are in, or any other business where they have to deal with the public."

Reports of Committees.

The next regular order of business, the report of the protective committee, was announced, and Pliny Norcross made the following statement:

This committee met at Madison several times during the session of the Legislature of 1897. We found there representatives of the gas interests, water companies and street-railway companies, but the electric-light interests exhibited little strength.

I suppose every central-station manager or superintendent or owner knows that instead of being taxed as we were prior to 1897 we now pay a percentage upon our gross income, not, of course, our net proceeds, but our gross income. There are 83 companies in this state doing electric lighting, street-car work and furnishing power. I think it would be entirely fair to say that there were not five companies in the whole state represented at the Legislature at any time. There were only one or two members of the Legislature interested in electric-light companies, and there was no concerted action at all. We did not know whether the majority of the electric-light owners in the state would be satisfied with a 1½ per cent. or one per cent. tax on gross earnings in preference to the manner in which they had been taxed. We did try to and did succeed in defeating or amending, by our presence at Madison, certain bills that we thought were antagonistic to our interests. Mr. Copeland was there three or four times; Mr. Mullen was there continually during a part of the winter; and I went from Janesville to the Legislature some six or seven times. We found bills presented for the express purpose of hindering and obstructing the electric-light industry of the state. I do not say the bills were drawn with that end in view; but when you see a bill introduced in any Legislature providing that a charter cannot be granted for a longer period than one year it is surprising. Anyone will admit that such a law is detrimental to the lighting interests and that a plant could not be put upon its feet with such a limitation. You could not sell a dollar's worth of stock; you could not invite capital to go into an enterprise of that kind. Other bills were introduced which provided that no charter should be granted unless first advertised in certain papers of the state, and certain other conditions performed, all of which were a hindrance to the electric-light interests. We sought in the best way we could to prevent such legislation, and we succeeded in a large degree in preventing damaging legislation.

See what the gas people did, and that shows what organization will do. Their strength lay in the third house. One of the prominent, strong, well-known members of the third house said to me during the last week or so of the session of the Legislature: "Well, Norcross, I hope you have succeeded as well as we have." I said, "I am afraid we have not; you didn't have any percentage bill." "Well, we didn't want any." I said, "We were not very hungry for it ourselves." He said, "Eighty or 85 per cent. of your companies cannot stay at home and expect to do anything. What you want is concerted action. No bill was passed requiring the gas companies and water powers of this state to pay a tax of a percentage of their gross earnings."

There is one point about the percentage bill which is decidedly disadvantageous under some circumstances. Every central-station plant in the state of Wisconsin was compelled on the first Monday or Tuesday of December last to file a sworn statement of its gross receipts, on which it had to pay 1½ per cent. Oftentimes that may not be as onerous a tax as it would be if the assessment was made by the assessors on a valuation of the property. But if an electric-light plant has been losing money, for instance, through competition with a strong gas company, you would not care to have it known. If your business during the last year has not been prosperous, you do not care to advertise that fact in the newspapers. Although it had that unpleasant feature about it, still the Milwaukee electric-light interests were in favor of the percentage plan, for the reason, as they said, that they dare not trust the assessors of the city to fix their valuation and assess it upon that ground. They preferred to pay, and did pay, a magnificent sum, about $53,000 on gross earnings of $1,800,000, for the electric light and street railway together; but the majority of the companies throughout the state did not favor that bill. They would much prefer to have left the matter of the valuation of their plants for taxation purposes to the assessors of their own towns.

The report of the committee on ways and means was called for, but the committee was not ready and no action was taken.

The committee on programme and entertainment presented the printed programme.

Midsummer Convention.

Several documents were presented by Mr. Pamperin, Mr. Cross and Mr. Hill, bearing upon the question of the midsummer meeting. There was considerable rivalry over the selection of the next meeting place, and it was accordingly determined to refer the whole matter to a committee consisting of Messrs. Norcross, Doherty, Hill, Dee and Korst, which will report to the president on April 1st.

Miscellaneous.

C. E. Van Bergen, F. S. Walker and J. M. Hill of Chicago were transferred to the active list of membership.

A paper was read by Alex Dow of Detroit on the subject of "Electric Lighting for Profit," and at its conclusion a vote of thanks was extended to the author.

The morning session on Thursday was occupied principally by two practical discussions. F. B. Badt of Chicago was introduced at the opening of the meeting. He made an address on "Topics of Interest to Central-station Men." His remarks were followed with close attention by the members, and upon the conclusion of his address a vote of thanks was extended to him by the association. The next feature of the meeting was an address on the "Physical and Chemical Properties of Volatile Oils in Boilers," by W. H. Edgar of Chicago. This developed into a practical talk, in which several of the members participated, asking questions. Special conditions were brought up and explained by Dr. Edgar. The afternoon session was devoted principally to the discussion of municipal ownership. Fred DeLand of Chicago had prepared a paper entitled "Municipal Socialism," which was read. This was really a continuation of the discussion begun by Mr. Dow of Detroit on Wednesday afternoon, and was followed up by Messrs. Bean, Dee, Doherty and Norcross. Another feature of interest of the afternoon meeting was the discussion of the plans for the proposed midsummer convention. Prof. Owens' paper on "Electricity in Municipal Ownership" was read at this meeting.

Social Features.

The committee on entertainment had as usual provided an agreeable programme for the entertainment of the members and visitors during the convention. On Wednesday evening a theater party was the principal feature, and Thursday evening was given up to the banquet. Mr. Mercein had been selected as toastmaster, and the following-named gentlemen responded to the several toasts:

"The Badger State," Governor Scofield.
"The Cream City," City Attorney Van Wyck.
"The Electrical Press," Frank L. Perry.
"The National Electric Light Association," W. Worth Bean.
"La Crosse and Hospitality," F. A. Copeland.
"The Light that Failed," H. L. Doherty.
"The Girls We Left Behind Us," H. G. Underwood.
"Ourselves," W. W. Low.

Mr. Stacey of the Electric Appliance company, Chicago, entertained the members with several songs, which were fully appreciated. Charles E. Brown of the Central Electric company made a very appropriate response. The banquet was one of the most pleasant features of the meeting, and was thoroughly appreciated by all who were present.

The New President.

F. A. Copeland of La Crosse, Wis., who was selected for the presidency for the ensuing year, has been identified with the association from its earliest days. Mr. Copeland has large lighting interests in Wisconsin, particularly in La Crosse, where he is the guiding spirit in the local electric lighting company which operates the Edison plant, the Brush company which furnishes the arc lights for street lighting, and also in the gas company.

Col. Copeland, as he has been known heretofore, is 52 years old, a native of Ypsilanti, Mich., and a veteran of the late war. He removed to Wisconsin in 1860, and in 1861 entered the Northern army, serving four years in the Third Wisconsin Cavalry. At the close of the war he engaged in the lumber business at La Crosse, and in 1871 became associated with Gov. C. C. Washburn. He succeeded to Gov. Washburn's business in 1887, and ever since that time has been largely interested in the lumber

trade at La Crosse. He is now the president and owner of the La Crosse Lumber company.

His electrical experience began in 1887, when he organized a company in La Crosse, of which he was made president, and installed an Edison plant to furnish incandescent lights for that city. The original plans of this company provided for an equipment to furnish 2,500 lights ultimately, although the promoters had no idea that this number of lamps would be required for several years. At the present time, however, the company is furnishing current for 15,000 incandescent lamps.

The Brush Electric Light company of La Crosse, which furnishes arc lamps for commercial use and for city lighting, and the La Crosse Gas Light company, which controls the gas-lighting business of the town, are operated by a syndicate of three, of which Mr. Copeland is a member.

President Copeland belongs to many social and benevolent organizations, but aside from the Northwestern association, in which he is deeply interested, and the Association of Edison Illuminating Companies, he has no connection with any electrical body.

The Chicago Delegation.

The largest representation of Chicago interests at a Northwestern Electrical association meeting that has ever been known in the history of the organization was that of the convention just closed at Milwaukee. On Wednesday morning a party of 60, under the direction of Frank L. Perry, took special cars on the Chicago, Milwaukee and St. Paul railroad. The trip to Milwaukee was unusually pleasant, as Mr. Perry had provided a mandolin orchestra to furnish music during the trip. The members of the party included several well-known electrical men from Michigan and other points in the vicinity of Chicago. The following is a complete list of the delegates and visitors comprising the Chicago party on the Milwaukee special:

J. S. Loomis,	Charles Jirjahn,
G. A. Hurd,	J. M. Worrill,
W. Wadhams,	Bernhard Hartley,
C. T. Gage,	A. C. Shaw,
J. B. Morrill,	T. E. D. Ritchie,
E. K. Batton,	George S. Whyte,
J. B. McKeague,	Robert J. Parvin,
J. B. O'Hara,	B. M. Myers,
H. E. Lang,	A. Louis Kuehmsted,
J. S. Maurer,	I. D. H. Ralph,
B. B. Downs,	J. G. Pomeroy,
A. W. Foster,	A. B. Conover,
H. O. Channon,	W. Worth Bean, Jr.,
W. Worth Bean,	E. H. Abadie,
George Peck,	H. G. Underwood,
W. H. Schott,	B. J. Shockley,
Alex Dow,	W. J. Trott,
F. S. Hunting,	Thomas Duncan,
F. Raymond,	J. E. Randall,
Lucius A. Hine,	R. D. Lucas,
L. M. Cole,	E. H. Hammond,
W. W. Low,	J. M. Hill,
A. C. Garrison,	Ed. R. Grier,
C. G. Guild,	J. M. Knox,
Frank H. Clark,	George S. Searing,
George P. Rex,	J. H. Culver,
George W. Patterson,	C. E. Kammeyer,
F. B. Badt,	E. D. Alexander.
J. H. Harding.	

Exhibits and Exhibitors.

Ever-present H. J. Gille was warmly welcomed by his many old Chicago friends.

John A. Roebling's Sons company of Chicago was represented by A. B. Conover, Jr.

L. W. Kittman, northwestern representative of the Chicago General Fixture company, was everywhere.

A. C. Langstadt of Langstadt & Croswell, supply dealers, Appleton, Wis., mingled with the crowd in Milwaukee.

R. J. Louis, in company with Albert W. Foster, represented the Triumph Electric company of Cincinnati, Ohio.

The Fostoria Incandescent Lamp company's interests were in the hands of B. M. Myers, who represented the company.

W. P. Clawson, electrician of the Goodrich Trasportation company, came up to Milwaukee by boat to mingle with the boys.

Channing T. Gage of the Washburn & Moen Manufacturing company was one of the first to register as a Chicago delegate.

James Wolff, "the immutable," of the New York Insulated Wire company, arrived Thursday afternoon, and was warmly welcomed. All were glad to see him.

Edward J. Patton, western representative of the Perkins Electric Switch Manufacturing company, proved a pleasant companion on a convention trip. Mr. Patton made no exhibit.

The Westinghouse Electric and Manufacturing company was represented by W. H. Whiteside, Henry Floy and W. S. Rugg, and exhibited type 8 alernating-current switchboard, showing the latest type of high-tension air blast switches, fuse block and round pattern instruments, a five horse-power, 200-volt induction motor with starting device, an alternating-current fan motor and a transformer.

Col. F. A. Copeland, who entertained the La Crosse convention so lavishly last summer, was warmly welcomed on his arrival at Milwaukee.

Western Manager C. H. Wilmerding of the Crocker-Wheeler Electric company deputized his energetic representative, Julian Roe, to represent him. Mr. Roe, it is safe to say, did not fail.

Charles S. Kehler, northwestern representative at Milwaukee for the Dearborn Drug and Chemical Works, Chicago, assisted W. H. Edgar in doing the honors. They distributed very neat souvenirs.

Mechanical Engineer G. A. Hurd, with the Crane company, Chicago, was constantly on hand during the sessions and added many leaves to that laurel wreath that he has made for himself as an entertainer.

Moser & Wilson, 39-43 West Washington street, Chicago, were engaged in showing both brass and aluminum castings. This enterprising firm has just closed a contract with J. H. Baker for 3,000 sewing-machine attachments.

John S. Maurer of the Crouse-Tremaine Carbon company and the Fostoria Incandescent Lamp company did good work, especially in advertising the duplex or double lamp that is now being pushed by the Fostoria company.

Hudson Jones of the Milwaukee Board of Underwriters drifted in and greeted his many old friends with whom he became so popular at the Marinette convention. Everyone inquired, too, for MacLaren, who is now in Mexico.

"Where is McGill of the Siemens & Halske company?" was a question that was frequently asked. Mr. McGill made so many friends for himself and his company at the La Crosse convention that his presence was much desired.

The O. C. Little Pulley Coating company of Menasha, Wis., showed a table of sample plates, illustrating the peculiarities of its pulley coating, which can be applied in one hour with a brush and be ready for use in six to ten hours.

George Cutter of Chicago announced that he was developing a fine line of new and ingenious electrical specialties. It has been remarked that there never was a convention at which George did not present a good "something new."

M. B. Austin of the New York Safety and Insulated Wire company and Holmes, Booth & Haydens arrived in Milwaukee with his wife the day before the Chicago delegation. Mr. Austin is well known throughout the Northwest.

Morgan Brooks, president of the Electrical Engineering company of Minneapolis, got in on Thursday. Mr. Brooks looked well, and if he prospers in keeping with his company and grows as rapidly, it would not be safe to predict the end.

John Child, the mica man, appeared also on Thursday, and did the honors for A. O. Schoonmaker. Mr. Child carries a stock of mica on which he has built up a very prosperous business; in fact, the carrying of stock in Chicago is one of its features.

Whyte of the Leschen-Macomber-Whyte company of Chicago, who has just returned from a visit abroad, was warmly welcomed by his host of Northwestern friends. He distributed the little pamphlet by Eugene Field, entitled "The Bottle and the Bird."

Manager Donohoe of the Chicago branch of the American Electrical Works arrived Thursday morning. Mr. Donohoe had not expected to be in attendance, and had dispatched Representative Hammond of the company with the Chicago delegation Wednesday morning.

Secretary and Treasurer William M. Smith of the Chicago Insulated Wire company surprised his friends by appearing for dinner Thursday afternoon. Mr. Smith is one of those popular men much in evidence at every convention, and it would never do for him to be absent.

George Searing, western manager for the Hart & Hegeman Manufacturing company, was on hand, but owing to the illness of his wife was obliged to leave early Thursday. Mr. Searing was missed at the banquet, as he is one of those fine fellows always in demand.

President C. D. Marsh of the Bryan-Marsh company and Joseph M. Hill, the company's western manager, had an interesting exhibit of Imperial incandescent lamps. Mr. Hill was, of course, decidedly in evidence through his aggressive efforts in behalf of his steamboat project for the midsummer convention.

One of the exhibits that attracted much attention was that of the Northern Electrical Manufacturing company of Madison, Wis. The company had several dynamos and motors in operation, one of the machines being a two horse-power motor, which is claimed to be the smallest of its capacity to be found on the American market. The motor, which was shown suspended on the side wall, is for the Wisconsin State University for special use in the lecture room. The other machine was a regular stock motor with patented speed-reducing shaft. The machines manufactured by the Northern company, as is well known, are particularly noted for their high quality of workmanship and perfect balance. They also run cool and sparkless.

Manager Cooke of the western department of the Jandus Electric company, Cleveland, had expected to leave his Chicago office for at least a day, in order to be present, but up to Thursday afternoon he had not put in an appearance and his absence was the cause of many inquiries.

A. Louis Kuehmsted and Francis Raymond were decidedly in evidence as the representatives of the Charles E. Gregory company. Mr. Kuehmsted is treasurer and general manager of the company, and in that capacity has done much to increase an already very prosperous business.

"Everything electrical" was the watchword of President L. W. Burch and Secretary and Treasurer F. L. Stagg of the Electrical Supply company of Madison, Wis. Mr. Stagg has recently joined forces with Mr. Burch, and it is said they are making a great "go" of it throughout the Northwest.

The McDermid Manufacturing company had Manager C. L. Burlingham on hand. Mr. Burlingham at first pleaded that pressure of business would prevent his attendance, but the convention fascinations and other things proved too much for him, and he appeared as an early bird Thursday morning.

Messrs. McKinlock and Camp, representing the successor to the Metropolitan Electric company of Chicago, arrived at the convention Thursday. These gentlemen have recently moved to a handsome new establishment on Randolph street, Chicago, and are making good headway with their new enterprise.

Representative Hammond of the Chicago branch of the American Electrical Works is an energetic salesman and has won universal respect through his good and conservative business methods, and he is rapidly adding to his many friends in western cities in which the American Electrical Works' well-known wires are in such favor.

The Raster Carbon Rheostat company, Chicago, had expected to make an exhibition of its new carbon rheostat, which, it is claimed, will carry overload of 200 per cent. and retain an almost equal resistance whether hot or cold, but found it inconvenient to do so. The office of this company is 414 Ashland block, Chicago.

Western Manager Edward R. Grier of the Bryant Electric company, Monadnock building, Chicago, was among the most energetic of the western representatives present. Mr. Grier has done most excellent work for his company and built up a large business. He was cordially welcomed at his first Northwestern convention.

L. N. Cole of the Duplex Manufacturing Electric company made his first convention trip. Mr. Cole presented the Duplex lamp guard and won many friends. Mr. Cole is starting a business in Chicago as manufacturers' agent, and is in line for select electrical specialties. His office is room 55 Dexter building, 84 Adams street, Chicago

The quick-witted and graceful response of Secretary Charles Brown of the Central Electric company to the sudden call from Toastmaster Mercein, at the banquet, added greatly to his laurels. This was Mr. Brown's first Northwestern convention, and a host of new friends, as well as his many old acquaintances, hope it will not be the last.

Filer & Stowell company, Milwaukee, took a decided interest in the success of the convention. Filer & Stowell manufacture a high-grade electric-light engine that is becoming popular with the electrical fraternity, owing to its close regulation and many other valuable features that make it particularly applicable to electric lighting and other service.

J. Mason Knox of the Varley Duplex Magnet company of New York joined the Chicago contingent and proved to be one of the most jovial of the party. Mr. Knox had with him a line of interesting samples of the Varley magnet windings, containing new features of great value to every purchaser of electrical magnet solenoids, with or without cores.

It was hoped until the last moment that Martin J. Insull of Sargent & Lundy, Chicago general western sales agents for the C. & C. company, could join the Chicago party. Owing to a pressure of business, however, Mr. Insull delegated T. E. D Ritchie. It is perhaps needless to say that Mr. Ritchie acquitted himself with credit to his company and Mr. Insull.

The "Washburn Trio," comprising Charles Jirjahn, manager, and W. Wadhams and J. M. Worrill, dispensed popular music on board the convention train. The way in which the Washburn Trio responded to the demands for more music proved them to be just the thing for such an occasion. The Washburn Trio have their headquarters in Chicago in Steinway Hall.

The Northern Electric Manufacturing company of Madison, Wis., came nobly to the front in the persons of A. O. Fox, secretary and treasurer, assisted by E. G. Richards. Mr. Fox is one of those energetic managers that spends an immense amount of time personally looking into the business and mechanical details appertaining to his company's extensive interests. The Northern Electric com-

pany, under Mr. Fox's management, has done splendid work, and in Milwaukee alone the company has already a number of model motor and dynamo installations. Mr. Fox was warmly welcomed by his many friends.

President James F. Cummings of the Armorite Interior Conduit company of Pittsburg arrived Thursday afternoon. Mr. Cummings, as usual, was the center of a host of warm friends. In fact, as an evidence of his popularity among the electrical fraternity, his room had been handsomely decorated for the occasion in his honor. No convention would be complete without the Conduit King.

Peterman & Wallber, electrical contractors, Milwaukee, were in constant attendance. This firm is just moving to a new store at 49 Oneida street, Milwaukee. Having been in business for three years, the firm has outgrown its present quarters. This firm will carry a most complete stock of electric light and house goods and street-railway supplies.

The electrical press was represented by A. C. Shaw and W. J. McConnell of the Electrical Engineer, W. R. C. Smith of the American Electrician, C. E. Luken of the American Directory, J. V. Church of the Electrical World, Carl E. Kammeyer of the Electrical Review, Fred DeLand of Electrical Engineering, and R. J. Parvin, Frank L. Perry and J. B. O'Hara of the Western Electrician.

The firm of McGill & Pomeroy, manufacturers' agents, Chicago, was represented by both partners. Mr. McGill recently slipped away from his bachelor friends and put himself on record as a man of substantiality. It would have been excusable had he delegated the Milwaukee convention to Pomeroy, but old associations proved too much for him, and once more he and Pomeroy did the honors together.

Western Manager Foster of the Chicago office of the Triumph Electric company was one of the most enthusiastic attendants at the convention, and was one of the first on hand to make up the Chicago party from Union Station. The Triumph company has had remarkable success with its machinery, and great credit is due to the Chicago office for the extensive western business that this concern now enjoys.

Manager W. H. Schott of the Hyde Park Thomson-Houston Light company, Chicago, was on hand at every business and social function during the three days' meeting. Mr. Schott is one of those central-station men whose genial personality makes him a friend at every turn. W. L. Githens, manager of the Hyde Park Electric Light and Power company, did the honors in company with Mr. Schott.

Lucius A. Hine of Lucius A. Hine & Co., electroplaters and enamelers, Chicago, joined the Chicago party and mingled with the delegates at the convention. Mr. Hine's company makes nickel-plating a specialty, and also brass and aluminum foundry specialties, as well as manufacturing builders' hardware and other hardware specialties. Mr. Hine is also in line to purchase old copper wire and worn-out commutator segments.

It had been expected up to the last moment that President Joseph Franklin, Jr., or perhaps Paul D. Cable, manager of sales of the Commercial Electrical Supply company, St. Louis, would join the St. Louis contingent that met the Chicago delegation at Union Station. "Taking stock," however, has many disagreeable features, and this time it resulted in keeping two popular men within the confines of 1007 Market street, St. Louis.

Of course, popular President Willard W. Low was on hand at every stage of the proceedings. Mr. Low came up from Chicago with the party on the St. Paul train, and he was accompanied by Messrs. Downs and Stacey. Mr. Low was really entitled to be on the entertainment committee, from the fact that he was slated to respond to the toast "Ourselves," and had in addition brought with him Mr. Stacey, the possessor, it is said, of the finest baritone voice in Englewood.

Manager Frank H. Clark of the western branch of the Electric Storage Battery company of Philadelphia made his first appearance at a Northwestern convention to tell all hands what he knew of his company's rapid strides during the last six months in the introduction of chloride accumulators. Mr. Clark is an old electrical man of considerable experience, having devoted many years to electrical work throughout the East. He made a very favorable impression.

Alex Dow's paper on "Electric Lighting for Profit" was pronounced by a central station man to be one of the most interesting, practical and useful papers that he had ever read. Francis B. Badt made a splendid address on "Topics of Interest to Central Station Men." John E. Randall, superintendent of the Columbia Incandescent Lamp company of St. Louis, accompanied Secretary and Treasurer Garrison, and read a paper on the "Present Efficiency of Incandescent Lamps."

W. H. Edgar, the president of the Dearborn Drug and Chemical company of Chicago, found time to present a most interesting and valuable treatise on his particular hobby, "Physical and Chemical Properties of Volatile Oils in Boilers." Mr. Edgar is a boiler doctor and no mistake, and he has the natural aversion of the cult to patent nostrums. The Dearborn Chemical company's great forte lies in the fact that it analyzes feed-waters for boilers and makes boiler compounds to suit them, guaranteeing the result.

A very interesting exhibit was given by the People's Electric company of Madison, Wis., in charge of F. H. Ford and C. W. Bacon. Among the numerous specialties displayed were Northern motors and dynamos in operation, the Ritter soldering iron, which is always hot and solders perfectly, Fagan cut-outs, O K batteries, Enamelac, a perfect insulating paint, Peerless armature compound, Rogers' commutator lubricant, Perfection dynamo brushes and general electrical supplies.

The Western Electric company of Chicago was represented by four of its energetic men. Manager A. L. Tucker of the supply department was early on hand, and he was joined during the convention by A. M. Little, N. W. Mixer and Thomas G. Grier, the company's advertising expert. Mr. Tucker distributed a neat announcement, of novel form, that read as follows: "We desire to inform the trade that we are now headquarters for all sizes of Okonite wires and cables, as well as Okonite and Manson tape. Please remember that this material can always be obtained from us at lowest market prices."

George W. Patterson, western representative for the American circular loom, Medbery railway material, Gordon-Burnham and Law primary batteries, as well as the Ohio storage battery, made a host of friends for himself. Mr. Patterson distributed on the convention train from Chicago carnations for the buttonhole, and during the convention presented American Beauties to the ladies in attendance. Mr. Patterson secured a large order for Gordon-Burnham batteries from the Milwaukee police department, and also appointed Julius Andrae agent for his batteries in Milwaukee.

City Passenger Agent Howard E. Laing, of the Chicago, Milwaukee & St. Paul railway, was early on hand at Union Station, Chicago, extending his services and that of other railroad men for the convenience of the crowd of delegates that took the special car over the St. Paul road for the Milwaukee convention. Incidentally it may be said that the St. Paul Railway company, General Passenger Agent Miller and the Milwaukee passenger agent, Martin Cramer, deserve credit for making the transportation arrangements thoroughly satisfactory to everyone. It is said that the party that left Chicago for Milwaukee over the St. Paul was the largest ever sent to the Northwestern convention from Chicago.

The American Rheostat company's exhibit consisted of one one-half horse power, 110-volt automatic starter, one five horse power, 110-volt automatic starter, one 7½ horse power, 110-volt automatic starter, and the front of a 100 horse power 110-volt automatic starter, one five horse power, 220-volt automatic speed controller, one 40-kilowatt, 110-volt rear-of-switchboard field rheostat, one three-kilowatt, 115-volt wall type field rheostat, one three-kilowatt, 115-volt wall type field rheostat, one 10 horse power, 220-volt reversible elevator controller, one five horse power, 220-volt perfection starter, one front for a 20 horse power 220-volt perfection starter, and one controller for sewing-machine work. The exhibit was in charge of Secretary and Treasurer J. Gilbert Hickcox and President Frank R. Bacon.

Charles E. Brown, secretary of the Central Electric company, got in Wednesday afternoon in time to join the theater party. Mr. Brown did the honors for his enterprising company, assisted by W. P. Upham, the company's northwestern representative. Mr. Upham, before Mr. Brown's arrival, had created much amusement and done no little skillful advertising for his company through his exhibition of the latest type of Edison phonograph. The company is now handling these goods most extensively and selling phonographs in large numbers. The outfit exhibited by Mr. Upham was of that practical type that eminently suits it for office service. It was regretted that President McKinlock could not have made the Central Electric party complete by his presence.

No Northwestern convention is considered absolutely complete without Manager of Sales E. H. Abadie, with his usual extensive and novel exhibition of the many high-grade electrical specialties of the Wagner Electric Manufacturing company at St. Louis. Mr. Abadie secured current from the local company's alternating circuit for the purpose of running in his parlor a 15 horse power alternating motor, belted to a 15 horse power direct-current generator, 110 volts. He exhibited his company's new type F transformers, also the new Wagner automatic line cut out, type XX and XL, and a new type of Wagner station instrument. Mr. Abadie made his exhibit complete and its impression lasting by the distribution of a novel Wagner calendar that represented in one picture the apparatus manufactured by the Wagner Electric Manufacturing company of St. Louis.

The Milwaukee convention was the first opportunity afforded Meysenburg & Badt of Chicago to introduce themselves in their new capacity of contracting and consulting engineers to the electrical fraternity of the Northwest. Both members of the company have long been known by reputation to the members of the Northwestern association, and Mr. Badt appeared in person at the convention in order to become better acquainted with the representatives of the companies interested. Meysenburg & Badt occupied a parlor near the convention hall, where they distributed literature descriptive of the apparatus for which they are manufacturers' agents. The following concerns and specialties were in the list: The Weston Electrical Instrument company, Hugo Reisinger, the Ward Leonard Electric company, the Helios Electric company, the Excelsior Electric company, the K. & W. company, Edison-Brown plastic rail bond, Badt hermetic cell. Mr. Badt was assisted by R. F. Schuchardt of Chicago and William Goltz of Milwaukee.

James C. Wormley had an exhibit of Wormley and Shelby lamps in Parlor 5, including all sizes from two to 250 volts, and one-fifth to 50 candle power. There were 75 regular lamps and about 100 miniature lamps, no two alike. Also an exhibit of filament in different stages of manufacture, showing square-cut carbons, manufactured exclusively in the United States by Prof. A. A. Chaillet of the Shelby Electric company, and squirted celluose carbons, made by Joseph Hardwick, superintendent of the same company. The different stages of filaments shown were liquid form, thread, before and after drying, carbonized and treated. The finished lamps were shown burning on a show frame made expressly for the convention. It attracted a great deal of attention.

The Cloos Electrical Engineering company of 342 Broadway, Milwaukee, made a fine exhibit of its safety and economical devices for high-potential currents. The general manager, H. R. King, and the electrical engineer, Mr. Cloos, successfully demonstrated the main features of their devices. "No arc—no spark—no danger." The company presented a highly interesting pamphlet, in which it showed outline representations of seven important devices for economy and safety, namely: Primary or dynamo switch, single and double coupling boxes, alternating and direct junction boxes, single branch cut-out, house or lamp switch or arc service single loop cut-out. Attached to each was a short explanation of its method of operation under the several circumstances in which it will be placed, together with its advantages.

Secretary and Treasurer A. C. Garrison of the Columbia Incandescent Lamp company, in company with Superintendent Randall and George P. Rex, manager of the Chicago office, did noble work for the Columbia lamp. Mr. Garrison presented a full line of samples of all the regular types of Columbia lamps and fancy lamps, including colored "Columbias;" he also showed a line of 220-volt lamps. A feature of his exhibit was the line of materials from which lamps are made, showing the filament in its first stage, the threads, carbonized filaments, etc. A portion of the exhibit that was guarded most zealously was a few of the original Gobel lamps, which proved a few years ago so strong a weapon of defense, as well as offense, in the hands of President Rhotehamel of the Columbia company in the sensational lamp suits of that period.

The General Electric company was represented by F. N. Boyer, J. Scribner and R. A. Swain from the Chicago office, and Thomas Ferris of the Milwaukee end. The exhibit comprised the latest types of apparatus and instruments—direct-current magnetic blow-out lightning arrester, designed for use on circuits carrying 850 volts, to take care of a lightning discharge of 8,000 to 10,000; a new series arc cut-out and ceiling board, the cut-out mounted on a porcelain base enclosed in an iron box which makes it perfectly weatherproof; arc lamps of the carbon feed type and enclosed long-burning direct current lamp, having a life of 125 hours, also the new long-burning alternating enclosed lamp with a life of about 30 hours. Other devices were the Wirt lightning arrester that caused so much comment for its efficiency at the Niagara power plant and the General Electric company's enclosed lightning arresters. Among the measuring instruments displayed were the new lamp inspector's indicating wattmeters. This instrument is designed to accurately and rapidly determine the watts per candle consumed by incandescent lamps. This instrument has been further developed and introduced as a portable indicating wattmeter, which meets the demand for instruments of this class. On account of the rapidity with which readings may be made these wattmeters will be invaluable for testing lamps in barrel lots. Another feature of the exhibit was the electrostatic ground detector. This instrument takes the place of the old type of ground detector for alternating currents, which comprised a transformer and lamp. The old type of ground detector is very unsatisfactory; on account of the capacity of the line the lamp will always glow, leaving the observer in doubt as to the actual condition of the line. The electrostatic ground detector is similar to the electrostatic voltmeter used in electrical laboratories, and is constructed for voltages ranging from one to 10,000. Volt and ampere meters for station, portable, testing and pocket uses were shown. Another novelty was a pocket case containing a complete set of repairing and adjusting tools for the Thomson recording wattmeter. The new direct-current stationary motor was connected and proved unique and interesting. This motor is designed to meet the increasing demand for small sizes of motors, and is constructed for any voltages ranging from one-eighth to one horse power capacity. This motor has been designed to produce the highest efficiency, due re

gard being made to construction as to weight and compactness where space is limited and rigid support unobtainable. By the adoption of magnetic circuit of laminated iron, the weight has been materially reduced. The ventilation has received special attention with marked degree of success. Heating tests show that with 50 per cent. overload for one hour no sparking is noticeable, and rise of temperature is almost imperceptible. A momentary overload of 100 per cent. is possible with little sparking. The motor can be placed in any position, either on the wall, floor or ceiling, and runs noiselessly with the highest degree of economy. The rheostat with which the motor is controlled is of the automatic overload attachment type, which breaks the circuit and prevents the burning out of the armature.

The Fort Wayne Electric corporation had an exhibit of enclosed arc lamps and meters in operation, 110 and 220-volt direct-current lamps and high and low-frequency alternating-current lamps. These lamps are all designed to burn singly on their respective circuits, thus avoiding running lamps in pairs. For 220-volt direct-current circuits this is a great convenience in operation. The alternating-current lamps are built for any frequency and are designed to operate from the ordinary transformer, using a choke coil in place of the resistance in the direct-current lamps, or to operate from the well-known special arc lamp transformer direct from the primary mains and without any choke coil or resistance of any kind, thus effecting quite a saving in cost of operation. These lamps are ornamental in design and are furnished in several different finishes, such as old iron, oxidized copper, etc. Several Duncan induction wattmeters were exhibited in operation. These new wattmeters are meeting with much favor from central-station men. Some of the most valuable features of these meters are their accuracy on wide ranges of load and voltage. Especially is this true of very large-sized meters, which are guaranteed even up to a 1,000-light size to start on one 16 candle power lamp. Another ingenious feature of this meter is the adjustable friction compensating device, which is used to accurately balance the friction of the meter, and allowing it to start on a very small current. This is also used to balance the friction at any voltage the meter may be operating on, or in overcoming the tendency of the meter to creep, if installed where there is considerable vibration. The Fort Wayne Electric corporation was represented by E. L. Draffen of Chicago, Thomas Duncan and F. S. Hunting of Fort Wayne. C. G. Guild, manager of the Jenney Electric Light and Power company of Fort Wayne, was also in attendance at the convention with the Fort Wayne delegation.

The cylinders of the 450 horse power engine used in the Kearny Electric Light and Power company's plant on the Passaic River road at West Arlington, N. J., blew out recently, wrecking the engine and almost demolishing one end of the building. All the lights in the township were put out by the accident. G. F. Woolston, the manager of the company, said that the accident was caused by malicious interference with the crosshead of the engine. He says that the engine was only put in place about three weeks before, and at the inspection which took place afterward was in perfect condition. He alleges that after the accident several bolts in the crosshead were found in such a position as to show that the engine had been tampered with. He suspects a former employe, now working for a rival company.

Jandus Enclosed Arc Lamp.

One of the most striking features of the electrical advancement of the year 1897 was the really remarkable increase in the use of enclosed arc lamps. In this development the Jandus Electric company of Cleveland has taken a leading part with a lamp that has been before the public of this country and Europe for three years. The Jandus lamp burns directly across the terminals of a potential circuit without waste of energy. This makes it desirable for a street-lighting system where multiple circuits are used, and for an underground system it is particularly adapted, because lamps can be connected wherever necessary without the inconvenience of running connecting wires between pairs of lamps or installing two lamps where only one is needed, or wasting the energy of one lamp, as was necessary under the old system of connecting two lamps in series. For interior lighting the economy and convenience of burning lamps singly cannot be overestimated. The Jandus lamp has been highly indorsed by the Board of Fire Underwriters generally. Mechanically and electrically it differs greatly from any other lamp.

The action of the lamp is extremely simple, as shown by Figs. 1 and 2. There is only a single winding which forms the solenoid, shown in section at A (Fig. 1). The armature B is held suspended in a strong magnetic field formed by the iron frame C of the lamp, which surrounds the winding. The regulation of the lamp is maintained by the weight of the armature, which is considerable, opposing the pull of the magnet. When the arc becomes too long from the consumption of the carbon the magnet will weaken, owing to the decrease in the current flowing through it caused by the increased resistance of the arc, and the armature will fall a little until the arc has regained its normal strength and the current consequently restored, when the magnet will again hold the armature stationary. The armature is the plunger for its own dash-pot, formed in a brass tube inside the coil. The carbon D, extended by a tube or sheath E, is inserted directly into the clutch, consisting of a pan-shaped piece F, carrying four clutch rings G, which fall by gravity and grip the carbon between the inclined side of the pan and the carbon. The clutch releases this and allows the carbon to feed when the armature has descended, until the clutch rings rest upon the releasing tube H. This form of clutch allows the unequal sizes of the carbons and sheath to be fed through it with equal accuracy. The current is conducted to the carbon through a series of 16 contact rin , I, which are arranged in a circle and make a flexible contact with the carbon. One of the great advantages of the absence of the carbon rod is that the current is conducted from the mechanism directly to the carbon. The upper carbon is held concentric with the lower by the globe cap, which is centered by the guides on the bottom of the box inclosing the contact rings. The armature carrying the clutch is therefore the only movable part in the entire mechanism of the lamp, the absence of springs or adjustments being one of the most notable features. The yoke J supports the inner globe and the lower carbon holder at its bottom end, where a ring admits the arms of the spider carried on the lower holder. This spider, by a turn to the right, locks the holder in position and closes the electrical circuit through the lamps. The outer globe is secured to the yoke at J by a circular nut, and is closed air-tight at this point by means of asbestos gaskets.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

JANDUS ENCLOSED ARC LAMP.

Fig. 3 illustrates the Jandus standard lamp for outdoor service. This lamp is provided with a waterproof case, and the terminal wires are led through water-tight rubber bushings, no hood being required. The rheostat is placed below the lower carbon holder inside the outer globe in a position where it will cast no shadow, and is thoroughly protected from the weather and readily accessible. This lamp is furnished in any style or color of finish desired. The lamp for inside service is shown in Fig. 4. The rheostat is placed in a canopy at the top of the lamp, where it can be readily adjusted by dropping the top half of the canopy. A cut-off switch is provided in the canopy. These lamps also are furnished in any desired style or color.

The Jandus lamp embodies the following advantages: Long life (the lamps burning 150 hours on a single half-inch carbon); lamps burn singly with economy on 110-volt circuit; perfect diffusion and uniform distribution of light; absence of flickering; practically noiseless in operation; fewness of working parts; decrease in cost of repairs, and small size.

CORRESPONDENCE.

New York Notes.

New York, January 18.—These are the days of great electrical projects in this city. The Metropolitan Street Railway company is constructing a great electrical system for its surface roads—a plant which, until a couple of weeks ago, was confidently reckoned as the largest electric railway installation in the world. But it is now announced, seemingly on the best of authority, that the Manhattan Elevated Railroad company will at once proceed to equip its lines for electrical operation, and this plant will probably have an aggregate capacity of 75,000 horse power, thus equaling and probably outstripping the plant for the surface lines. Of course, the generating plant may be placed in several power houses, and the figure refers to the ultimate capacity when all the lines in contemplation are fitted for electrical operation.

In the meantime the tunnel scheme of the Rapid Transit commission is laid on the shelf, after years of laborious preparation and litigation. When the Appellate Court required that the contractor for the proposed road should furnish a bond of $15,000,000, the commissioners had only one hope—that the Metropolitan company would come forward to build the road they had planned. This last hope was dashed to the ground on last Wednesday, when President Vreeland of the Metropolitan company sent a letter to the Rapid Transit commissioners stating that his company did not feel justified in embarking in the construction of an underground road. "We entered upon the consideration of the subject," says Mr. Vreeland, "with the belief that the necessity for improved communication between the upper and lower parts of the city was so great that relief must certainly be afforded, and we were sanguine in the expectation that an examination of the subject would show that the Metropolitan Street Railway company could render this public service, and at the same time, in connection with its surface roads, could render greater facility to the public and secure greater profits for itself than anyone else possibly could do. Soon after the public announcement was made of our intention, the elevated railroad companies appear to have expressed their willingness to enter into an arrangement for the extension and improvement of their roads, which the previous city administration endeavored, without success, to obtain from them in preference to the construction of an underground road. This movement on the part of the elevated railroads has been received with approval by the present local authorities. We have no disposition to do anything to obstruct nor to discredit the sincerity and the success of this undertaking, and we therefore do not feel that, so long as the alternative method of securing the desired result appears about to be undertaken, we would be justified in asking our stockholders to engage in the construction of an underground road." This letter and the circumstances generally show that the rapid-transit problem in the city of New York has been a great game, with the Manhattan and Metropolitan companies and the city political leaders as the players. The exact relations of the gamesters are known to only a very few persons; but one thing seems certain—the underground plan has been defeated, for years at least.

A special meeting of the Rapid Transit commission was held yesterday, and the report of the contract committee was received. The committee reports that the exaction of a $15,000,000 bond practically prohibits the whole scheme. It suggests that the court be asked to modify its decision. It recommends in effect that the board rest on its oars and watch closely the proposed improvements and extensions of the Manhattan company. The commissioners adopted the report and also these resolutions:

"Resolved, That the president be requested to invite from the Manhattan Railway company the early presentation of any application for additional facilities or extensions which that company may now desire, and to state in such invitation that this board is ready to go as far, upon assurances of prompt action on the part of the company, and of its willingness to make due compensation to the city, as the interests of the city will permit, toward enabling the company to take such steps as will relieve the needs of the city.

"Resolved, That the counsel of the board be instructed to present a petition to the Appellate Division of the Supreme Court, asking for some modi

fication of the recent decision relative to the bond to be required under section 34 of the Rapid Transit Act; such petition to be in harmony with the views expressed in the said report of the committee, and to be verified by the president and authenticated by the seal of this board."

As to the Manhattan company, there seems to be no doubt as to the fact of the electrical equipment, and it is reported that the Walker company will get the contract. This statement was attributed to Treasurer Ferguson of the Walker company on Saturday: "S. H. Short, general manager of the company, is in New York city, where he expects to close a contract within two days for the electrical equipment of the Manhattan elevated railroad. The contract will call for machinery, etc., to a total value of between $7,000,000 and $8,000,000, to be delivered at the earliest date possible. If the contract is secured our works will be operated night and day. The contract is as good as closed, as all details have been agreed upon." Such a contract would undoubtedly be the largest contract for electrical equipment ever closed in this country, but, so far as I have been able to ascertain, no papers have yet been signed. Details of the plant are, of course, largely conjecture. The Sun gives General Manager Fransioli as authority for the statement that the electrical plant which will replace the present steam motors will have to be capable of developing 75,000 horse power. This calculation is based upon the fact that during the busiest hours of the day about 300 of the total of 330 steam motors are now in use, and each motor is required to exert its total of 250 horse power. A large use of storage batteries is suggested. Four power houses of 20,000 horse power capacity each may be built, or possibly one great generating plant might be constructed on the water front, with alternating-current transmission and rotary converters in sub-stations—all is guesswork. The Sprague multiple-unit system is naturally mentioned, but what the prospect is for its adoption is not known.

Russell Sage is said not to be the authority on Manhattan Elevated that he was, but nevertheless the following statement, reported to have been made by him, is of interest: "The matter has been in the hands of the president and the engineers of the company. The company has prepared its own specifications, and the electrical equipment companies will submit bids under these. The work will, of course, go to the lowest responsible bidders. It is quite probable that it will be divided among several companies. A third rail will be used to carry the current, and it is proposed to have a motor on each car, so that the cars may be run separately, or in trains, as desired. It is the intention to apply electricity on one line first, either the Second Avenue line or the Ninth Avenue line. I am in favor of applying it at the outset on the Ninth Avenue line, so that there may be a demonstration of the effectiveness of the use of electricity the entire distance from the Battery to Harlem. Not so much time as a year will be required. The equipment of the lines with electricity is to be followed by extensions of the lines themselves. It is intended to place elevators at all the stations, and, in brief, to make the elevated lines a perfect system in all respects. The directors of the Manhattan company are a unit on this subject. The cost of the change from steam to electricity on the elevated roads will be large, but once it is made there will be an important saving in operating expenses. The elevated roads carry 700,000 passengers a day without injury to a single person. One reason why electricity has not been adopted before was the determination that in any change in motive power the element of safety should be maintained. It is not true that the Manhattan company is to join with surface railroad companies in establishing power plants. It will have its own independent plant from beginning to end, and its roads will be operated, as in the past, independently of other roads. The elevated roads constitute the ideal transportation system for New York. The people have not wanted an underground system, and it is fortunate for them that they are not to be saddled with the expense of it."

Electrical demonstrations in court are becoming quite frequent, as the volume of commercial electrical litigation increases, and judges, jurymen and attendants are always interested in the experiments. A few days ago the Nassau Electric Railroad company of Brooklyn was the defendant in a suit for damages brought by Mrs. Olga Carlson, who claimed that she had her right hip fractured [illegible] from an open car. She said that the fuse of the motor burned out, that there [illegible], and that a flame flashed up which frightened [illegible] that she jumped from the car. [illegible] the company [illegible] from [illegible] to the Supreme Court room in Brooklyn and [illegible] there with a motor box. A fuse [illegible] other appliances used on trolley cars were [illegible] for the purpose of demonstrating that no flame such as the plaintiff described could have flashed up. A practical illustration was [illegible] the jury. The fuse burned out [illegible]. Justice Keogh [illegible] experiment.

There is talk of [illegible] of all the Brooklyn surface and elevated railway companies, but the rumor seems to be an [illegible]. The [illegible] asserts that all the [illegible] financial [illegible] are in shape for reorganizing the Brooklyn [illegible]

vated Railroad company, and that a contract will be signed with the General Electric company to equip the road electrically for traction purposes. Although the work of equipping the Brooklyn Elevated will not approach in magnitude the making of a plant for the Manhattan Elevated, it will be a very large job. President Uhlman said, at the time he announced the intention of the company to use the new system, that it would mean an expenditure of nearly $3,000,000 to make all the changes which are in contemplation. The Brooklyn elevated road has 20 miles of double track, and it uses 95 steam locomotives, 286 passenger coaches and 14 working cars. The change of motive power at this time was largely the outcome of the plan to bring the trains of the elevated road across the bridge.

As a result of negotiations that have been practically completed the Third Avenue Railroad company is to add to its system the important network of trolley lines in the borough of the Bronx, owned by the Union Railway company. The latter company is commonly called the "Huckleberry," a reference to the fact that its lines extend through a large section of thinly peopled territory. The sale will be closed within the next 10 or 12 days, it is said. The acquirement of the Huckleberry lines by the Third Avenue company will give to the latter about 37 miles of owned and leased tracks in the old annexed district and beyond, with the right to build 54 miles more. It is claimed that the Metropolitan and Third Avenue companies are now in complete accord. M. S.

PERSONAL

Irving Hale, who has been appointed brigadier-general of the Colorado militia, is well known to officers in the army as the man who went through West Point with the highest standing ever attained. He resigned several years ago, after five years' service in the engineers, and has since been in charge of the Denver office of the General Electric company.

William J. Martin, manager of the San Francisco office of the Western Union Telegraph company, has resigned, after 25 years of service, to go into other business. Mr. Martin is an accomplished telegraph manager, and, in conjunction with Superintendent Jaynes, has carried through successfully some remarkable work. One of his notable achievements was the handling on time of the mass of special and press dispatches sent out from Carson, Nev., on the day of the Fitzsimmons-Corbett prize-fight.

G. Herbert Condict, the chief engineer of the Electric Vehicle company of New York, was in Chicago on Monday and Tuesday to transact some business connected with the winding up of the affairs of the Englewood and Chicago Electric Street Railway company. Mr. Condict is confident that the electric carriage has a very promising future, and he thinks that with good city streets there is no reason why heavier vehicles, such as general delivery wagons and even trucks and drays, should not be successfully operated by electrical power also. He consider that the vehicles operated by gas or oil motors may come into use in the outlying and country districts, where the absence of charging stations and the power-consuming condition of the roads militate against the electrically operated vehicles.

It having been decided to remove the accounting department of Westinghouse, Church, Kerr & Co. from their New York office to their Pittsburg office, and as this necessitated the change of residence from the East to the West of those who are in charge of this department, the engineering force of the company tendered a farewell dinner to Messrs. Warren L. Murray and Gardner W. Kimball on the eve of their departure on January 8th. The affair was held in one of the private dining rooms of Mouquin's Fulton-street restaurant, and was planned as a surprise for both guests, proving a most enjoyable affair in all respects. Plates were set for 22, there being but a single absentee, who was out of town. Mr. Walter C. Kerr, vice president of the company, sat at the head of the table, with the two guests of the evening on either side, and Mr. Otis L. Williams, treasurer, at the other end. The bill of fare had been gotten up by several of the brightest members of the engineering force, who substituted mechanical for the usual French terms, to the amusement and, in some cases, to the consternation of their brother engineers. After the dinner had gotten well under way Mr. Williams as toastmaster allowed no individual to escape, and there were by consequence 21 responses in regular order besides several which were interpolated. Mr. Kerr, in a few early remarks, expressed his pleasure at meeting the force in this form for the first time, and suggested that an annual dinner, or perhaps one more frequent, would not be a bad idea. Mr. Murray has been employed by Westinghouse, Church, Kerr & Co. for 15 years and Mr. Kimball nearly as long, and the New York office felt great regret at their leaving the East in the call of duty. A number of presentations were made to the two departing guests as tokens of esteem from their fellow employes.

ELECTRIC LIGHTING.

The Huntsville Electric and Power company, Huntsville, Ala., has let the contract for the erection of a new power house on West Clinton street. A sum exceeding $10,000 will be expended in improving the electric plant and electricity will be supplied at all hours.

A satisfactory isolated plant has just been installed in the establishment of the Jones Dry Goods company of Kansas City. A 25-kilowatt, Westinghouse, multipolar, 125-volt dynamo supplies current to 31 long-burning Jandus enclosed arc lamps and 200 incandescent lights. The plant, including the switchboard, was installed by the Hodge, Walsh & Loring Electrical Engineering company.

On the bill of complaint filed by the Massachusetts Loan and Trust company against the Citizens' Electric Light and Power company of Houston, Texas, Judge Bryant has issued an order appointing Blake Dupree of Houston receiver of the company. The Massachusetts Loan and Trust company is the holder of 150 first-mortgage bonds of the company of the denomination of $1,000 and bearing interest at the rate of six per cent. per annum. The company has defaulted on the interest on these bonds since September, 1896.

The Bureau of Information of the League of American Municipalities has begun the task of gathering statistical matter pertaining to municipal and private ownership of electric lighting plants. Statistics will be gathered from all cities and towns of 5,000 inhabitants and over to show the cost of lights under both private and municipal ownership, giving the cost of each plant, capacity, operating expenses, the items of interest, depreciation, repairs, etc. It is the intention to make a comparison between municipal and private ownership.

Newbern, N. C., people are amused by a difference between Dick Williams, who owns the electric lights of that town, and A. R. Dennison, Newbern's new Republican mayor. The mayor employed a Philadelphia expert to test the arc lights, on the supposition that Williams was not giving lights of 1,200 candle power, according to contract. The test was attempted in whole or in part secretly, and Williams got after the investigators with a shotgun, claiming that they were "monkeying" with his property. There are several law cases resulting from the controversy.

A Pittsburg dispatch states that within 12 months the catacombs of Rome will be illuminated by incandescent electric lights. The Westinghouse company has received a dispatch from its representative in Rome announcing that he had secured the contract for lighting the catacombs of St. Calixtus, St. Agnes, St. Cyraca, St. Demitilla, St. Priscilla and St. Bentianus. Some months ago the subterranean burial ground of St. Calixtus was lighted, and the effect was so satisfactory that the persons in charge decided to have electricity put in all the catacombs of the city.

ELECTRIC RAILWAYS.

The Chicago North Shore Street Railway company (the Evanston line) held its annual meeting January 17th. As the line is leased by the North Chicago Street Railroad company, the business transacted amounted to little more than the re-election of the old directors and officers.

An electric car on the Slaterville and Woonsocket (R. I.) line dashed uncontrolled down Aldrich's Hill one day last week, jumped the tracks at the foot of the hill, and, crashing through a rail fence, dropped over an embankment and landed right side up in a field. The 14 passengers were bruised and frightened and were piled on the floor of the car. None was hurt seriously.

At the meeting of the Chicago City Council on Monday evening, Alderman Gazzolo introduced an ordinance granting permission to the Chicago Central Railroad company to lay one or two tracks along the following-named streets: Commencing at the south line of Congress street at the intersection of Congress and Green streets, thence running northerly over and along Green street to the north line of Washington street, thence east over and along Washington street, passing over the Washington street bridge and viaduct, to the east line of Market street, thence south over and along Market street to the south line of Monroe street, thence east over and along Monroe street to the west line of Michigan avenue; also commencing at the west line of Green street at the intersection of Quincy street, extended, with right of condemnation, thence east over and along Quincy street to the east line of Canal, thence northerly and along Canal street to the north line of Washington street at intersection of Canal street. The ordinance permits the company to lease its tracks to any other corporation; fixes a five-cent fare; extends over 50 years, at the end of which time the city can purchase the plant by arbitration; fixes compensation by license fee of $1 a car, and provides that lines shall be completed within three years and for an indemnity bond of $50,000 within 30 days of passage of ordinance.

TELEGRAPH.

A six-mile submarine cable has been completed at Passaic, N. J., for the Postal Telegraph company. It is said to be the longest of its size ever made in this country, and weighs 125,000 pounds. Its diameter is 1¾ inches. It will be stretched across Great South Bay, between Fire Island and Babylon, giving the Postal a marine service of its own.

TELEPHONE.

New York capitalists are said to be arranging to secure a telephone franchise in Omaha. The rates at present are high, but all plans of would-be competitors have been defeated. Now the initiative and referendum is in effect in Omaha, and by this means the new company expects to get a hold.

It is asserted that the long-distance telephone record was broken on January 5th, at Gallatin, Tenn., when John H. Cross, a representative of the Bell company, talked with the operator at Norfolk, Va. The circuit passed through Nashville, Evansville, Terre Haute, Indianapolis, Pittsburg, Philadelphia, Washington and Richmond, making fully 1,600 miles.

The lowest rate charged in Atlanta, Ga., by the Bell Telephone company is $30 a year for telephones, while in Savannah, for instance, the company charges $18 for the same service. This has made the local subscribers dissatisfied, and the proposition of the Standard Telephone company to put on the $18 rate at once has been hailed with delight; but it means another prolonged telephone war.

The Creek Council at its last session granted to Captain S. B. Severs exclusive right to build telephone lines in the territory of the Creek nation. Captain Severs has been negotiating since for material to construct a network of lines connecting all the towns of importance by wire. He expects to go to work in a very short time and connect it with lines north in Kansas and south in the Choctaw nation, reaching to Denison, Texas.

The railway commissioners at Raleigh, N. C., have made a sweeping reduction in the rates for the yearly rental of telephones, by ordering the following in effect after February 1, 1898: Business telephones, special, $30; two and three-party wire, each $24; four and five-party wire, each, $18; residence telephones, special wire, $18; two and three-party wire, each, $16; four and five-party wire, each, $14. These rates do not apply to service outside the corporate limits of any city or town.

ELECTRICAL SECURITIES.

A dividend of one per cent. has been declared by the Columbus Street Railway company, payable February 1st.

Announcement is made that the $1,000,000 five per cent. collateral trust gold bonds of the Erie Telegraph and Telephone company mentioned last week have been fully subscribed for.

The last quarterly report of the Albany Railway company shows material improvement over the conditions that obtained a year ago. The gross earnings were $157,987, an increase of $20,630, and the net earnings were $55,262, the surplus being $31,107.

Ogden Street Railway company first-mortgage six per cent. bonds, principal and interest guaranteed by the West Chicago Street Railroad company, to which it is leased for 99 years, were placed on the market last week. There has been completed 34½ miles of the Ogden road, upon which these bonds are a first and only lien at the rate of $15,000 per mile.

The Columbus Street Railroad company reports gross earnings for December of $56,276, an increase of $3,753 as compared with the same month of the previous year, and net $31,242, an increase of $4,698. For the year ended December 31st the gross earnings were $[illegible], a decrease of $20,[illegible] as compared with the corresponding period of the previous year, and net $[illegible], an increase of $1,349.

Holders of Atlantic Avenue railroad five per cent. improvement bonds and Brooklyn, Bath and West End railroad five per cent. general mortgage bonds have been notified that the syndicate formed to assist in readjusting the bonded indebtedness and leasehold interests of the Nassau Electric railroad and the Atlantic Avenue railroad of Brooklyn, having purchased more than two-thirds of the bonds mentioned at [illegible] and accrued interest, is authorized to offer the same price to the holders of any of the remaining bonds, provided they are deposited on or before February 1st.

MISCELLANEOUS.

The curiosity of a pet baboon in Milwaukee led to the creature's death. The monkey was a most intelligent animal and had its home in the basement of a theater. Every since it had been in the theater it had taken a great interest in the incandescent electric lights, which were out of its reach, sitting and eyeing them constantly for hours at a time. Several nights ago it sprang up on the chandelier and grabbed one of the globes in its mouth. It probably swallowed some of the glass, for since then the baboon had been sick, and recently it died.

The postponed lecture of Edward B. Ellicott on "Fire-alarm Systems," before the Engineers' Club of Chicago, will be given on the evening of January 28th.

The Metropolitan Electric Construction company of New York city has been incorporated with a capital of $50,000, to equip electric railroads, elevators, and deal in electrical apparatus. The directors are Albert B. Chandler and Edward C. Platt of Brooklyn, E. H. Johnson of New York and W. D. MacQuesten and H. V. Jennings of Mount Vernon.

Presumably as the result of the recent acetylene explosion in Jersey City, the fire commissioners of that city have adopted regulations for the manufacture and storage of acetylene gas. The regulations provide that the manufacture of carbide of calcium or the liquefaction of carbide of calcium be prohibited except under certain prescribed limitations to be designated by the Board of Fire Commissioners, and the board declines to permit the use of any acetylene gas regenerator in the city except those devices first submitted to it for careful test, examination and approval. It is further provided that the use or storage of carbide of calcium be confined to quantities of five pounds each, which must be stored in heavy block-tin vessels, and until ready for use hermetically sealed, and that no dwelling, factory or other building be permitted to keep on storage a total quantity in excess of 25 pounds in cans or vessels of five pounds each. Those desirous of storing in the city a quantity of calcium carbide or liquefied acetylene gas in excess of the limitations given are to be allowed to do so only upon formal request to the board.

TRADE NEWS.

The factory of the American Battery company at 42 West Quincy street, Chicago, having been destroyed by fire, the new works, as well as the office, are at 174 South Clinton street, Chicago.

Huebel & Manger Brooklyn, N. Y., the well-known manufacturers of bells, annunciators, etc., are presenting to their friends a convenient souvenir in the shape of a cigar rest and paper weight. All recipients of these novelties will appreciate the favor.

The Atlantic Alcatraz Asphalt company, formerly the California Asphalt company of New York, says that it changed its name because other concerns offered their goods as coming from the California Asphalt company. This is taken as a sure sign that the company is producing good material.

To accommodate their large and constantly increasing trade Eyanson & Armpriester of Philadelphia have found it necessary to remove to Commerce street, corner of Seventh. This well known firm is the manufacturer of knife switches and switchboards, which it has installed all over the United States, and which are said to have given the best of satisfaction. It has just issued a new catalogue, "D," which will be cheerfully sent on request.

A valuable little book for all designing water-piping is the catalogue of high-pressure hydraulic fittings and flanges issued by the Tight Joint company, 159-161 Bank street, New York. Only a comparatively small portion of the pamphlet is devoted to advertising matter, the greater part being information compiled by John Hatt for the use of those designing hydraulic plants. The tables and formulæ seem to have been carefully prepared or selected and should be useful.

W. R. Mason, the agent of the Walker company in St. Louis, has just closed a contract with the St. Louis, Belleville and Suburban Railway company for two 200-kilowatt, direct-connected dynamos at 150 revolutions and eight sets of double 50 horse power car equipments complete. The dynamos are to be connected to Russell engines. Mr. Mason has but recently returned from the Cleveland factory, which he found full of work, shipments being made almost daily to all parts of the world.

The Walker company is now building at its Cleveland works a 1,600-kilowatt, direct-connected generator for the Union Railway company of New York city. This, with the two now being completed for the Brooklyn Heights Railroad company, will make three of these 1,600-kilowatt machines finished in as many months. In addition to this generator for the Union Railway company, the Walker company is building for that company 40 double No. 4 A street-railway equipments. The equipments are to be fitted with the new type S solenoid blow-out controller which has attracted so much attention. The current for these motors will be fed to the line from a Walker switchboard, now being built at New Haven. The Metropolitan Street Railway company of Kansas City, which is operating a 1,600-kilowatt Walker generator, is about to increase its plant by the addition of a generator of 1,200 kilowatts [illegible]. As a contrast to these immense machines it may be mentioned that the Walker company is building a 25-kilowatt lighting generator for Mr. J. J. Astor's new yacht. The foreign shipments during the next few months will include 100 double 3 S street-railway equipments, with 200 controllers, for Dresden, Germany; six double No. 3 N equipments with type S controllers, and two double No. 3 N equipments. Besides these railway motors with accessories there will be one 150-kilowatt belted railway generator with its switchboard and a 75-kilowatt belted booster for Japan, also with a switchboard. This makes over 7,500 horse power in street-railway motors alone that is building at the Cleveland works, to say nothing of the horse-power output in generators.

The interesting announcement that the property and business of the Missouri Telephone Manufacturing company has been sold to the Central Telephone and Electric company comes from St. Louis. The latter company was recently organized, but is energetically pushing for business. It has issued an illustrated catalogue, and says that it solicits trade on a quality basis—a good position for an independent telephone manufacturing company to take. The Central Telephone and Electric company offers to ship a pair of telephones anywhere in the United States to a responsible person for 15 days' trial. If the instruments prove unsatisfactory, they may be returned at the company's expense. The new company makes switchboards and telephone supplies, and its catalogue is sent on application to it at 1123 Pine street, St. Louis.

BUSINESS.

The Western Electric company has received another large shipment of interior conduit. This company also manufactures the Simplex tree insulator. Anyone interested in tree insulators should send for a descriptive circular.

The new catalogue of the Gamewell Fire-alarm Telegraph company of New York is a handsome one. An interesting historical sketch of the fire-alarm telegraph is given, and the Gamewell apparatus is clearly described and pleasingly illustrated.

Resistance wire is in such wide demand in electrical work that the little pamphlet of John A. Roebling's Sons company of 117-119 Liberty street, New York, on Climax resistance wire, is useful. This wire is said to have nearly 50 times the resistance of copper. Tables showing its properties for different sizes are given.

The Brunt regulating sockets for regulating the candle power of incandescent lamps, now being introduced by the Central Electric company, Chicago, are said to be meeting with a ready sale. These goods have forced their way to the front as one of the best articles of the kind yet produced for regulating the candle power of incandescent lamps.

The Cutter Electrical and Manufacturing company of 1112 Sansom street, Philadelphia, has just issued a new catalogue and price-list of its well-known I-T-E circuit breakers, embodying all the latest types—single-pole, double-pole, double-pole double-coil and triple-pole instruments being listed. This will be sent upon receipt of request, either from its office at 120 Liberty street, New York, or from Philadelphia.

The Buckeye Electric company, after a series of experiments, has completed and is now placing in the market a 220-volt Buckeye incandescent lamp. The specially prepared cellulose coiled filament, with anchor, is used. The maintenance of candle power is claimed to be absolute. Efficiency, life and quality of illumination are guaranteed to be satisfactory. J. H. Cooke reports many inquiries and orders received at the Chicago office, 753 Monadnock building.

A. O. Schoonmaker of 158 William street, New York, who has for so long been identified in the production of mica, reports indications for an increase in his line of business during the year. He has been obliged to increase his capacity of production in order to meet orders. In caring for his western trade, special arrangements have been consummated whereby a complete line of different sizes of mica will be carried at the Chicago office and also at San Francisco.

The new catalogue of the Stow Manufacturing company of Binghamton shows the manifold uses in power transmission to which the Stow flexible shaft may be put. The flexible shaft is peculiarly applicable for use with electric motors, as it exemplifies the principle of taking the tool to the work instead of the work to the tool. It enables power to be applied in many cramped positions where the tool would have to be operated by hand if the flexible shaft were not available. It also enters as a driving factor into the construction of many special devices now on the market and in general use. These are used for wood carving, cloth cutting, metal burnishing and polishing, sandpapering, stone drilling and polishing, sash, door and blind boring, flue cleaning, multiple drill[illegible], ing drills, time recorders, dental engines, surgical instruments, die work, etc. The Stow company makes electric motors especially adapted for use in connection with its portable shafts and illustrates a number of interesting combinations. [illegible]

catalogue is No. 7, and will be found valuable by all power users.

At this season of the year the amount of iron line material that enters into the business of a large supply house is indeed surprising. The Electric Appliance company, Chicago, states that it is carrying a stock of these goods that will enable it to make prompt shipments of anything up to a carload, and yet its capacity has been taxed on these goods. The iron mills throughout the country have had a large amount of business this season, and it has at times been very difficult to get iron line material. The Electric Appliance company, however, anticipated this condition, and during the season has been able to keep its stock in shape so that all orders for this material could be shipped promptly. It states that its stock is still being kept up and that customers wanting iron construction material promptly from Chicago stock will not be disappointed.

The Rochester (N. Y.) Electrical Manufacturing company has been incorporated and will at once engage in the manufacture of the electrical cut-out invented by Louis W. Miller and other devices of a similar character. The company is capitalized at $50,000 and the officers are: President, Hon. William E. Werner; vice-president, J. Miller Kelly; secretary and treasurer, George A. Brayer; general superintendent, Louis W. Miller. Mr. Miller is electrician of the police telephone service in Rochester, and his experience impressed him with need of a cut-out for use in connection with the signal service. Accordingly he invented and placed in the patrol boxes and fire-alarm boxes a cut-out that has proved of value to the city. Formerly it was a frequent occurrence during a storm for the wires running through the city to get crossed, and all of the boxes on that circuit would burn out. This would entail a considerable loss, besides leaving a portion of the city cut off from communication with the fire houses or police headquarters. But when the cut-outs were put in this expense and danger was obviated. The cut-out patented by Mr. Miller is to be put in telephones, watchmen's clocks, district-messenger boxes, fire-alarm gongs and central-office electrical apparatus.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued January 11, 1898.

597,002. Graphite Rheostat. Edward W. Jewell, Chicago, Ill. Application filed May 8, 1897.

A working circuit forms one distinct path for the electric current, while a thin layer of graphite evenly distributed upon an insulating base forms a second path of high resistance. A contact arm is arranged to travel along the graphite layer and make electrical contact therewith, the cross sectional area of the graphite path being substantially equal at all points of adjustment of the arm, an electrical connection being established between the arm and one terminal of the patient's circuit, and an electrical connection between the other terminal of the patient's circuit and one terminal of the graphite path, the patient's circuit and the graphite path being thus in shunt relation to each other, whereby the voltage in the working circuit varies according to the relative position of the arm upon the graphite path.

597,003. Apparatus for Stating Time and Number of Telephonic Conversations. Erich Kosanke, Carl Fuhr and Bruno Krausse, Wilmersdorf, Germany. Application filed July 5, 1895.

In a telephone system it is proposed to employ the combination of a registering time mechanism, means controlled by the movement of the parts at the calling and called subscribers to a position for conversation for starting the register, and means controlled by the restoration of the parts at the calling subscribers for stopping the register.

597,018. Method of Regulating Speed of Series Electric Motors. Horace F. Parshall, London, England. Application filed April 5, 1897.

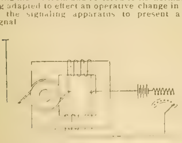
The art of regulating the speed and torque of a series electric motor consists in shunting the field coils of the motor by a source of electromotive force, imparting energy from the line to the source of electromotive force when the current is large, and taking energy therefrom to maintain the field when the line current is cut down by the counter-electromotive force of the motor.

597,036. Electric Railway Conduit System. Ralph F. Thompson, Alexandria, La. Application filed July 13, 1897.

The conduit is provided with the air and water-tight chambers, located one on each side of the trolley slot, and having insulators, trolley wires, partitions and curved projections, in combination with the trolley arms having contact wheels, friction rollers and insulators.

597,052. Telephone Exchange System. William W. Dean, St. Louis, Mo. Application filed September 22, 1897.

Two telephone lines extend from subscribers' stations and unite at the exchange, with switching apparatus for uniting and disconnecting the lines, a signal receiver at one end of the stations, a signaling generator for operating the same, a signaling apparatus adapted to present and maintain a clearing-out signal at the exchange, suitable circuit connection between the signaling apparatus and the called subscriber's line, a switch-lever adapted to change the circuit condition and the operative condition of the signaling apparatus to give a clearing-out signal, means for preventing the signaling apparatus from presenting a clearing-out signal with the switch-lever unchanged from its normal idle position, the switch-lever in being moved from and restored to its normal position being adapted to effect an operative change in the condition of the signaling apparatus to present a clearing-out signal



NO. 597,052.

597,053. Telephone Exchange System. William W. Dean, St. Louis, Mo. Application filed September 22, 1897.

In a trunk line telephone system the combination is claimed with two switchboards, of a plurality of [illegible] connected with each of the boards, [illegible] the subscribers' stations [illegible] on the board, switching apparatus [illegible] uniting subscribers for conversation [illegible] means for including the [illegible] receiver at a called subscriber's station [illegible] with the latter board, means for removing the [illegible] at the subscriber's station [illegible] the other board, each being adapted when [illegible] the [illegible] station to operate the latter [illegible] the calling generator from circuit with the [illegible] bell [illegible] jack for the trunk line [illegible] switching apparatus and the [illegible] effect the removal of the generator [illegible]

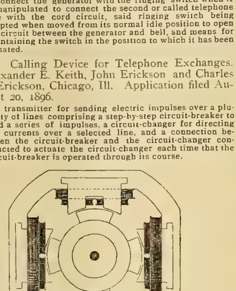
597,054. Telephone [illegible] St. Louis, Mo. [illegible] 22, 1897.

One claim is given: In a telephone exchange [illegible] the combination with a plurality of [illegible] of telephone lines extending [illegible] signal receivers or bells at the [illegible] circuit for forming a continuous [illegible] telephone line, a connecting plug adapted to connect [illegible]

telephone line with another telephone line, a ringing switch, a calling generator, means for connecting the generator with and disconnecting it from the ringing switch, said plug being adapted to operate or control said means to connect the generator with the ringing switch when it is manipulated to connect the second or called telephone line with the cord circuit, said ringing switch being adapted when moved from its normal idle position to open the circuit between the generator and bell, and means for maintaining the switch in the position to which it has been actuated.

597,062. Calling Device for Telephone Exchanges. Alexander E. Keith, John Erickson and Charles J. Erickson, Chicago, Ill. Application filed August 20, 1896.

A transmitter for sending electric impulses over a plurality of lines comprising a step-by-step circuit-breaker to send a series of impulses, a circuit-changer for directing the currents over a selected line, and a connection between the circuit-breaker and the circuit-changer constructed to actuate the circuit-changer each time that the circuit-breaker is operated through its course.



NO. 597,090

597,090. Dynamo-electric Machine. Johannes Sohlman, Wiborg, Finland. Application filed May 22, 1897. Patented in Sweden September 14, 1895.

An even number of stationary pairs of pole-pieces project radially from a casing, each pole-piece being surrounded by an induction coil, while every two of the pole-pieces are surrounded by an exciting coil; a rotating core is placed centrally in the casing and arranged in such a manner in relation to the pole-piece that the magnetism is fully reversed in the core during its rotation.

597,137. Static Induction Electric Generator. Adrian L. Bogart, Jamaica, N. Y. Application filed May 5, 1897.

A cylinder for an electrical generator of the static induction or influence type is made of insulating material and provided with a removable plug of similar material, and metallic contact springs carried by the plug and adapted to contact with the stationary member of the device.

597,140. Insulating Trolley Hanger. Edward J. Cook, Cleveland, Ohio. Application filed December 2, 1897.

Claim is made for the combination with the body, having a projecting portion and reduced neck and a cap fitted onto the body, an insulating bolt having an enlarged head fitted to the body and adapted to be engaged by the cap, and a series of malleable projections extending entirely around the lower edge of the cap.

597,150. Means for Operating Electric Switches and Extinguishing Sparks Thereof. Jacob B. Knudsen, Chicago, Ill. Application filed June 16, 1897.

There is described the combination with contact terminals and with a switch for controlling the passage of current between the terminals, of an air cylinder, a spring-actuated piston within the air cylinder, a regulating valve provided with a discharge port communicating with one end of the air cylinder, and a piston within the regulating valve for controlling the discharge port.

597,156. Electric Railway Motor. Charles J. Van Depoele, Lynn, Mass., C. A. Coffin and Albert Walsh, Boston, Mass. Application filed June 11, 1890.

As means of controlling electric motors a circuit interrupting device is adapted to interrupt the circuit of the current supply at a number of points simultaneously, and a current changing device effecting relative changes in the circuits of the translating device during the time that the current is so interrupted.

597,1[illegible]. Automatic Tender for Trolley-operating Ropes. Charles F. Wilson, Brooklyn, N. Y. Application filed October 1, 1896.

[illegible] automatic tender, comprising a suitable support, a [illegible] reel mounted on the support, a dog carried by the reel [illegible] mounted to swing outwardly into engagement with the support, and a dog regulating spring consisting of a flat or plate spring carried by the dog, and [illegible] adjusting the free end of the spring in a lateral direction to increase or diminish its retarding effect upon the [illegible]

597,172. Filament for Incandescent Lamps. Erwin F. von Wilmowsky, Boston, Mass. Application filed September 3, 1896.

This filament is composed substantially of boron.

597,202. Electric Railway. Hosea W. Libbey, Boston Mass. Application filed March 10, 1897.

An electric conductor is supported by the side of the rail, a T-piece consisting of a number of sections insulated from each other and supported by springs from the web of the rail and spring contact pieces consisting of two disks of hard rubber, a cylinder of soft rubber and a metal rod passing through the center.

597,213. Telephone Attachment. Philipp J. Böse, Bremen, Germany. Application filed November 16, 1896.

The telephone call-box is fitted with the usual supporting-hook; a vertical rod is pivotally supported in bearings at its ends, provided with an arm fixedly secured thereto and projecting therefrom to support the receiving instrument; a spring holds the arm toward the user of the instrument, and an arm is fastened to the vertical rod to swing across and press down the hook for closing the bell circuit when the instrument is not in use.

597,239. Primary Battery. Charles J. Hubbell and Harry C. Hubbell, Scranton, Pa. Application filed May 8, 1897.

The hollow plates or elements have a support comprising a metallic post secured within the battery-cell, and provided with spring-fingers for engaging the inside of the element.

597,244. Combination Gas and Electric Light Fixture. Joseph W. Parkin, Philadelphia, Pa. Application filed December 23, 1896.

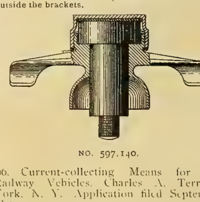
In a combination gas and electric light fixture there are a body portion having a chamber and an inlet passage, a plug in the chamber and having a bore communicating with the passage and provided with a passage for conductors, insulated conducting rings in the chamber and two resilient contact devices in the chamber suitably insulated and adapted to contact with the rings.

597,265. Controller for Electric Motors. Charles S. Cook, Pittsburg, Pa. Application filed January 2, 1897.

An electric motor having a shunt or compound-wound field magnet, a starting, stopping and reversing switch therefor provided with means for reversing the direction of current flow in the armature winding and maintaining a closed circuit which includes the armature and shunt windings in series with each other and constitutes the only path for current during the reversing operation.

597,282. Trolley Guard. Henry F. Hendricks and James H. Denton, Philadelphia, Pa. Application filed September 12, 1896.

The first claim is given: In a trolley, a fork, a bolt secured thereto, a trolley wheel journaled on the bolt, diverging brackets secured to the bolt at an angle to the fork, a second bolt connecting the brackets, a secondary trolley wheel journaled on the second bolt between the brackets, and star-wheels journaled on the second bolts outside the brackets.



NO. 597,140.

597,306. Current-collecting Means for Electric Railway Vehicles. Charles A. Terry, New York, N. Y. Application filed September 17, 1896.

A laterally extending contact device for making contact with overhead supply conductors comprises a plurality of electrically connected rotatable elements of substantially the same diameter, and a supporting frame having a horizontal bearing-rod upon which the rotatable elements are mounted.

597,373. Electric Searing Pen. Henry Green, Hartford, Conn. Application filed April 16, 1897.

A writing implement comprises a handle, a cap, a resistance medium incased by the cap, and a searing pen embedded in the resistance medium and passing through one end of the cap, the searing pen being insulated from the cap.

597,374. Controller for Electric Cars. John C. Henry, Denver, Colo. Application filed November 6, 1897.

The method of braking electric cars consists in changing the armatures of two electric motors propelling the car from parallel to series connection, increasing the magnetization of the fields of the motors as the current in the armature decreases due to retardation of the speed of the motors, and then short-circuiting the armatures of the motors under separately excited fields.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, JANUARY 29, 1898. No. 5

Effects of the Storm on Overhead Circuits.

The severe storm of the night of January 22d had a disastrous effect on the poles and overhead wires of the electrical circuits in and near Chicago. The storm was peculiarly vicious in character, with a high velocity of wind, and rain, sleet and snow, as the temperature varied. It was in all respects one of the worst in recent years, and the telephone and telegraph wires suffered accordingly. The service on the surface electric railways, including the storage-battery road, was badly crippled for several hours, while the trains on the cable and steam roads were also delayed.

In the outlying districts of the city poles and wires were down in all directions. City Electrician Ellicott estimated that 500 poles were down in the city of Chicago on Sunday morning. The trouble was caused by the great weight of the wires, coated with successive layers of snow and ice, coupled with the strength of the wind in exposed situations. The storm created great inconvenience, but the principal danger of it arose from the failure of many of the fire-alarm telegraph lines to operate. Linemen were sent out into the storm to repair the broken and grounded wires, as fast as they could be secured, and, as a precaution made necessary by the emergency, the chief of the Fire Department caused lookout men to be placed in all the old fire towers to watch for fires and to report them by telephone. Within 24 hours, however, the telegraphic service was again efficient, and fortunately no material fire loss was caused by the defective means of communication.

The Chicago Telephone company suffered severely from the storm on its outlying pole lines carrying long trunk and toll circuits. In the downtown districts, however, where the wires are laid underground, the service was comparatively good. Thus in the district covered by the Main, Express and Harrison exchanges, with 7,472 telephones, there were only 188 "troubles" reported during the storm period. In the district outside, with a smaller number of telephones, there were over 1,000 troubles. However, the total of 1,800 troubles compares very favorably with the great storm of November, 1895, when 3,500 troubles were reported. As the storm of a few days ago was nearly as violent as that of '95, the decrease is largely credited to the improved condition of the plant. The storm also illustrated very clearly the great superiority of buried wires. It likewise proved that the protective telephone apparatus was effective, as the fuses and other devices served to save the telephones in every instance, although there were uncounted crosses with trolley and other heavy-current wires.

The accompanying illustration shows a bad breakdown of a heavy pole line, due to the storm. The photograph was taken on Cottage Grove avenue, near Sixty-ninth street. Here there is a line of about 80 wires running north and south, beside the iron fence of Oakwoods Cemetery, with a wide sweep of sparsely settled territory to the west. The line is mostly made up of telephone circuits running to South Chicago, Hammond, Pullman and Chicago Heights, although there are some of the city's fire-alarm wires on the poles. The picture shows the destruction wrought by the storm better than a verbal description. The poles—sound cedar posts—were completely broken in two, and for a considerable distance the heavy tops, with cross-arms and wires, were lying on or over the iron fence. There were several bad breaks in the lines of the Chicago Telephone company, but this was the worst of all. The company pressed all the linemen it could secure into service to repair the damage at this and other points. By Sunday night an emergency cable had been laid along the ground at the point illustrated, and this cable was in use Monday morning.

EFFECTS OF THE STORM ON OVERHEAD CIRCUITS —A BREAK IN A CHICAGO TELEPHONE LINE.

The ice and snow formation on the wires was unusually heavy. In some cases there were clearly defined coatings of ice and snow about a tiny central core of wire. In others the accumulation was of hardened snow and oval in shape. Mr. Hibbard, the manager of the telephone company, measured one of the latter, on an ordinary single telephone wire, and found it to be 11½ inches in circumference.

The lesson of a storm such as that of last Saturday night is that the added first cost of the best line construction is very good economy. Mr. Ellicott proposes to put all main-line circuits of the city fire-alarm telegraphs underground next summer, and the policy of the Chicago Telephone company in relation to overhead circuits will be to erect shorter poles and to put more wires in aerial cables and fewer bare wires on pole lines.

New Commissioner of Patents.

Charles H. Duell of Syracuse, N. Y., has been appointed United States commissioner of patents to succeed Benjamin Butterworth, deceased. Mr. Duell has been in active practice as a patent lawyer for 10 or 12 years, but is better known in the East than in the West. His father filled the same office for several years.

Chicago Has a Department of Electricity.

At the meeting of the Chicago City Council on Monday evening the ordinance creating a Department of Electricity was passed by a large majority. The mayor has approved the ordinance, which is now a law. The text of the ordinance, as introduced, was given in the Western Electrician of January 8th, and but few changes were made before final passage. It is stipulated, however, that the fire marshal and the chief of police shall retain a certain control of the chief of police shall retain a certain control of the operators and linemen in the fire-alarm and police-telegraph branches of the service, with supervision over the location of call boxes and the like. One important feature of the law is the provision that hereafter all contractors must obtain a permit from the department before entering upon any job of electrical construction work, either for new installations or repair work. No charge is made for these permits, but the applications will enable the department to keep track of all work needing inspection. Under the old law the owners, and not the contractors, were supposed to make the applications, and many failed to do so. The appointments have not been made for the department, but the principal ones will undoubtedly be as follows: City electrician, Edward B. Ellicott (salary, $4,000); assistant city electrician, David M. Hyland (salary, $3,250); superintendent of construction, William Carroll (salary, $2,000).

Inventors in Convention.

The American Association of Inventors and Manufactures was in session in Washington, D. C., last week. The association numbers among its members some of the most prominent inventors and scientists in the country, among whom are Nikola Tesla, Dr. R. J. Gatling, Albert A. Pope, Alexander Graham Bell, Elihu Thomson and others. Officers for the ensuing year were elected as follows: President, T. H. Richards, Hartford; secretary and treasurer, Arthur Stewart, Baltimore. The vice-presidents are Messrs. Anderson, Serrell, Dodge and Ely. The executive committee is made up of Messrs. Billings, Gatling, Taylor, Pope, Frazer, Stone, Miller, Schulte and Dubois.

The following amendments to the constitution were adopted:

"The object of this association is to maintain and foster the patent system of the United States, to increase the efficiency of its operation and the

stability of patent property. To accomplish these results, the association aims to strengthen public opinion favorable to the patent system, by demonstrating the enormous advantages which have been derived by the people of the United States therefrom, in the increase of manufactures and material wealth which have resulted from new machines and methods produced under the stimulus of the legal protection afforded to inventors by the patent system of the United States.

"To procure from Congress legislation authorizing the Patent Office, the only department of the government which pays all of its expenses out of its income, to spend so much of that income as may be necessary for the scientific, thorough and efficient examination of applications for patents, to the end that patents may be granted only for inventions undoubtedly new.

"To strengthen the legal remedies for the protection of such patents as may be issued after a thorough examination."

Resolutions were adopted expressing the sorrow felt by the members at the death of Gardiner G. Hubbard of Washington, who was a member of long standing, and that of Patent Commissioner Butterworth. Resolutions were also adopted favoring the removal from the Patent Office to the National Museum of such models as are not now required in connection with the transaction of business, such models being "relics of the unprecedented progress of science and the useful arts during the last half century."

The accounts of the secretary and treasurer showed that the association stands on a firm financial basis and has a considerable balance in the treasury.

Electrical Operation of a Great Grain Elevator.

By Orrin E. Dunlap.

The application of Niagara power to the operation of the Great Northern elevator in Buffalo is one of the most interesting and notable events in connection with the transmission of Niagara's energy that has yet occurred. This is so because the elevator is the greatest structure of its kind in the United States, and the use of the electric current in it marks its occupation of a field in which there is a large demand for power. This is especially true of the Buffalo elevator district, where the great grain-storage structures are very numerous about the Ohio-street transformer station of the Cataract Power and Conduit company, which acts as the distributing agent for Niagara power in the city of Buffalo.

In the Great Northern elevator the application of electric power is very neat, and use has demonstrated that it is very efficient, while to visitors it appears wonderful and novel. But then novelty is more or less notable about the entire structure, and it is in its way recognized as the conception of an original and able mind. The elevator stands on Ganson street and the Blackwell Canal. In length it is 395 feet; the width is 150 feet and the height 177 feet. Stone, steel and brick are the materials which have been allowed to enter into its construction, and it is, therefore, considered to be thoroughly fireproof. Preparatory to its erection a deep excavation was made and then thousands of piles were driven, and on this foundation an additional foundation of masonry was erected. The piles were driven from 30 to 50 feet below the water line to solid rock. On the masonry the steel columns were erected. The storage capacity of the elevator is about 3,000,000 bushels, provided by great steel bins, cylindrical in form. Of these tanks or bins there are 30 which are 39 feet in diameter, 85 feet high, with a capacity of 80,000 bushels each; 18 that are 15 feet six inches in diameter, 85 feet high, each having a capacity of 18,000 bushels, and 18 small shipping tanks, nine feet nine inches in diameter and about 60 feet high. The steel used in the construction of the bins varies from one-fourth to one-half of an inch in thickness, the total weight of steel used in the bins being in the neighborhood of 6,000 tons. The larger bins are supported on a patent circular girder plan, the idea of James J. Hill, president of the Great Northern companies. For all interior work the elevator is of such novel construction, the exterior appearance is very similar to that of any elevator, all the bins being inclosed by brick walls in which nearly 4,000,000 brick were used in addition to 250,000 on the ground floor. The brick portion of the building is surmounted by a cupola running the entire length of the top. This cupola is about 40 feet wide and 50 feet high. It is covered with corrugated iron, and on the side the name "Great Northern" stands out very prominently in large white letter

The ground floor of the building, paved with brick, contains openings, being provided so that the floor can be flushed when necessary to keep it clean, the drainage being into the canal. From the east end of this floor an electric passenger elevator, run by a 10 horse power motor, goes to the scale floor. At the west end a spiral stairway of steel, with convenient landings, leads to the upper floors. In the southwest corner of this floor an office is provided for Superintendent John Lane, whose selection for this position marks him as one of the most efficient elevator men in the country. In the northwest corner of this floor the electrical controlling equipment is placed. Both of these rooms, the superintendent's office and switchboard or transformer room, are practically stone and brick vaults, well designed to preserve the fireproof feature of the building. Looking down this floor one sees the cone-shaped bottoms of the tanks with their spouts. In the center of the ground floor there is a 50 horse power motor used to move the marine towers and also operating a cable under the building to enable the company to do car switching from the railroad yards to the elevator by electrical power. The same motor gives power to dust-collector fans, the dust collector and sweeping devices of the elevator being very complete.

The main part of the elevator building is equipped with 10 inside legs, each driven by a 50 horse power motor by means of a rope drive, a gear and pinion. These legs are about 177 feet high, carry two rows of buckets and handle about 15,000 bushels of grain per hour. Each leg is provided with hopper and scales, upon which the grain is weighed before it goes into storage. The motors for operating the legs are placed in a row on the south side of the floor over the bins and present a very business-like appearance. A 100 horse power motor for operating fans and dust collectors is also in the line near the middle. The elevator is also provided with 10 patent double-jointed distributing spouts for distributing the grain from the bins and scales, while two other spouts of the same pattern are used for carrying the grain from the cleaners to bins.

The conveyor belts in use in the Great Northern are the largest belts of the kind in use in the world, it is said. These belts are two in number, each 60 inches wide and about 740 feet long. The motors which operate them stand at the west end of the building; they are two in number, reversible, and of 20 horse power each. The belts are provided with Robinson's patent reversible self-moving trippers. Their capacity is about 40,000 bushels per hour each. In the top of the cupola the elevator heads and gearing for reducing speed are located, while on the next floor below there are 27 steel garners, each of a capacity of 1,500 bushels, and on the next floor below, or second of the cupola, there are 10 steel hopper scales, each with a capacity of 1,500 bushels. The floors of the upper stories are of sheet steel.

The elevator fronts on the Blackwell Canal, the dock between being 24 feet wide and built of stone. This dock has two railroad tracks of the standard gauge, on which are operated three marine towers, each having 32 wheels. The towers are built of steel, and each has a marine leg capable of elevating about 40,000 bushels of grain per hour. Each tower is provided with a 100 horse power motor, the current to operate which is obtained from three trolley wires running the entire length of the building on the outside at a height of about 40 feet from the ground. Trolley shoes are used instead of wheels. The switches and starters of the tower motors are mounted over the motors. The towers are moved back and forth along the dock at will on the same principle as cars on a cable line, the power for operating the cable coming from the 50 horse power motor in the center of the ground floor, as stated. As each tower has a leg capable of elevating 20,000 bushels of grain per hour, it is apparent that the capacity of the three towers is about 60,000 bushels per hour, or 600,000 bushels in 10 hours.

While the unloading capacity of the elevator is all that could be desired, its shipping facilities are equally up to modern demands. On the north side of the building there are double tracks for cars while loading, and an awning protects grain and men from undesirable weather conditions. On these tracks nine cars can be loaded at a time on either track, and in addition there is a track on the inside of the building along the north side of the ground floor. It is estimated that 400 cars can be shipped daily, also that 200,000 bushels or thereabouts can be shipped by vessels on the Blackwell Canal. At the west end of the elevator a slip has been provided with a depth of water equal to that in the Blackwell Canal, for loading canalboats, and by this means 100,000 bushels more may be shipped daily.

The power for the operation of the Great Northern elevator is generated at Niagara Falls, about 30 miles distant from the point of use, in the power station of the Niagara Falls Power company. It is developed in units of 5,000 horse power at a voltage of about 2,200. It passes from the power house to the transformer station adjoining, where the voltage is raised from 2,200 to about 11,000 by the means of transformers built by the General Electric company. At this last-mentioned voltage it is sent out on the transmission line en route to Buffalo. The transmission line now has six copper cables, or two three-phase systems. The power for use in Buffalo in the elevator district is passed through the Ohio-street transformer station and the voltage reduced from 11,000 to about 2,200. It is at this voltage that it is received at the Great Northern elevator and converted into 440 volts, at which voltage it is used. Two large converters of about 600 horse power each perform this service. The current received is of three-phase and used as two-phase. Four cables, each of 1,000,000 circular mils, run from the transformers to the main switchboard. This switchboard is of white marble and has nine panels. Upon these panels are mounted the devices for controlling the motors. All the motors are of the Westinghouse induction type, six-pole, 440-volt, 500-revolution. It will be noted that all the motors in the building, with the exception of the marine tower motors, are started and stopped from this main switchboard, also that the motors are brushless and thus sparkless, the system being adopted in order to prevent the ignition of the grain dust, which is a factor of danger in a grain elevator. So far the service of the motors has been ideal, and they can be run without harm 100 per

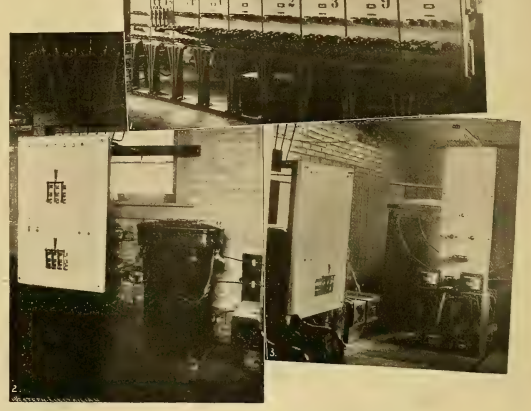


Fig. 2. Switchboard for Lighting.

Fig. 1. Main Switchboard.
Fig. 3. Six Hundred Horse Power Transformers.

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cent. overloaded. All wiring is of open-work construction, with single-wire supports and flexible cable, rubber-covered. The lights are run on two-phase, 104-volt circuits. There are 420 lights in the building, all controlled from a board in the switch room on the ground floor and by distribution boxes for each floor. Call-bells and telephones have been established throughout the building. Views of the plant are given on pages 62, 63 and 64.

The elevator was built for the Great Northern Elevator company of Buffalo. The incorporators were Henry W. Cannon, the president of the Chase National Bank of New York, Frederick W. Bobbett of New York and W. C. Farrington of Buffalo. Mr. Farrington has been made president and general manager of the company, and Mr. Bobbett secretary and treasurer. Mr. Farrington's office is in Buffalo and Mr. Bobbett's in New York. The man who built the elevator is D. A. Robinson, who, although a young man, is recognized as one of the ablest men in elevator construction in the country to-day. Many of the unique features of the elevator are involved in the brain of J. J. Hill, president of the Great Northern railroad, a man of energy and progressive spirit. The elevator cost nearly half a million dollars, but this is only a portion of the investment made by Great Northern interests in Buffalo of late years. Close to the grain elevator on the east the magnificent steamers of the Great Northern steamship line are tied in their winter quarters, and, with their outfit, represent about $3,000,000. The construction of the elevator must be considered as a reflection of the progressive spirit of President Hill, who from a poor Canadian farm boy has risen to be a great factor in the commercial world.

Physical and Chemical Properties of Volatile Oils in Boilers.[1]

By W. H. Edgar.

It is my purpose to speak on the subject of the use of volatile oils, hydrocarbon, kerosene, and oils of that nature, in the steam boiler. I do not believe there are any cases in this country where we get petroleum or other oils in our feed-water supply, but the general laws of nature are such that our waters are heavily impregnated with lime and magnesia, which are the main ingredients, the scale-forming salts, which form an incrustation in the steam boiler, which incrustation is a poor conductor of heat as compared with iron, so that we are forced to look around for something to counteract the evil effects of this incrustation and to get rid of it if possible. This has led us to put most everything into our steam boilers, and among the different reagents employed have been volatile oils. I know that they have pumped turpentine and resinous oils into boilers up in the lumber districts; because they found in districts where they were sawing hemlock and oak that the sap and washings from them have apparently kept the boilers clean; so they thought that if they put a little of the product they were working on into their boilers it would have the same effect, it all being vegetable. These volatile oils, including turpentine and oils of that nature, are all hydrocarbons, and when they have been put into steam boilers they have caused a corrosion or general eating and deleterious effects upon the boilers from their use. In the oil fields, years ago, they put in what they called an oil brick, made from petroleum, and that was not successful; in the last few years they have been in the habit of pumping into the steam boilers kerosene, etc. I know of one man in Chicago who is at the head of some six or eight large plants belonging to one of the largest corporations we have in the city of Chicago, who put naphtha or gasoline into his boilers for years, and would persist in saying that it did the work to perfection; but he had to stop using it, due to the leaks, etc.

There are two ways of looking at this subject of incrustation and its proper antidotal reagents. A boiler is very much like the human system. We are liable to injure it, and we are liable to put something into it where the effects are worse than the disease; so we must take up both sides of the question. Now, I want to bring out a few points about volatile oils and kerosene. Kerosene is a light distillate hydrocarbon, and has been used very extensively throughout the country, as I tried here and there, and dropped for one or another reason; and I will offer these suggestions and take up these points without any personal motive whatever, for I have none; but I will just simply take up the evil effects of kerosene and petroleum and their different distillates.

Kerosene pumped into the steam boiler with the object of converting the incrustation into such form that we can readily wash it out, or prevent its formation, I shall consider in the first place. Kerosene is a hydrocarbon. If we had a carbohydrate, an animal oil, we would get an oleate radical and could possibly get the oleate of lime or oleate of magnesia, which, however, would not help us out; but we could get a chemical reaction from carbohydrate, having a combining acid radical there; but in the hydrocarbons we have no possible acid radical; we have not the base; we have not the combination that will take the place of either base or an acid radical, and we get no chemical reaction whatever, and the action of the kerosene is purely mechanical, following the laws of capillary attraction. If I dip a blotter into water, the water will run up the side and penetrate the blotter; if the blotter is set over a tumbler of water the water will penetrate through the substance of the blotter; and if you play a hose on a brick wall the moisture will penetrate to the other side. Now, kerosene, being a light volatile oil, will penetrate everything of a porous nature, such as lime, magnesia, etc., and will penetrate to a greater extent and more rapidly than water. The scale incrustation in the boiler will be softened, will be penetrated by this kerosene, due to the laws of capillary attraction; the scale being porous, the kerosene will work through to the iron; and when it comes in contact with hot metal the oil will run back of the sheet of the scale, between the scale incrustation and the iron, and when you shut your boilers, draw your fires and let out your water, your boiler contracts, the iron contracting and expanding with the application of heat. Now, you have put a substance of different physical properties, of a different nature, between your lime and magnesia incrustation and your iron sheet or plate. The lime and magnesia, little particles of them, will attach themselves to the sheet, due to the general affinity that they have for hot metal; they cling very tenaciously to the iron, and when this substance comes in between, you have lessened that adhesive property, and the incrustation is not adhering as tenaciously, and, consequently, being a non-conductor and not expanding and contracting uniformly with the iron, it is more readily scaled off, and you get a great quantity of this broken scale from the continued use of a volatile oil such as kerosene. The kerosene does not change the chemical composition of the scale; its action is purely mechanical.

Fig. 2. View Across the Line of Fifty Horse Power Motors. Fig. 1. Fifty Horse Power Motor on Ground Floor to Operate Cables. Fig. 3. The Elevator as it Appears from the Lake.

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There are other points to be considered. Kerosene volatilizes in the steam boiler; you get probably a third over with your steam; it passes off immediately and begins to come over from about 150 degrees to 300 degrees Fahrenheit. This kerosene that passes over constitutes hydrocarbon distillate, and your steam is hydrogen and oxygen, and you know the evil effects from condensation in a steam plant; you know that every year you have in your heating system to put in a few more nipples or an elbow here and there. When you put in a light volatile oil of a hydrocarbon nature, you intensify that action; you get a series of oxidizing hydrocarbon reagents that will intensify that general pitting and grooving 100 per cent.; that is, you will get the general eating through of the joints and connections probably a hundred times as quick as you would otherwise. Besides that, the kerosene carries over into your cylinders. It is a part of the cylinder oil in the first place; the cylinder oils all come from petroleum, except the animal oils. The kerosene is a solvent for them. It dilutes your cylinder oil; it has a tendency to change its lubricating properties just that much, and with the hydrogen and oxygen of the water and the compound formed in the distillate you will get blackening of your piston rods and the deleterious general oxidizing effect on your rings, and if you have a metallic packing you will have hard work keeping your packing in your engine. From these same distillates, these same products formed in your distillation, you will have the pitting and the general eating through of all the threads of your joints and connections through your entire steam system. Not only that, but the part that is left in the steam boiler and the part that goes through your scale and reaches the iron cannot stand that high heat. It is carbonized; it is all decomposed, and in the carbonizing of the hydrocarbon oil in the presence of iron or against the iron sheet, you are going to carbonize your iron, and you will have there a blistered-appearing spot where the iron has been carbonized; it will be of a blackish, blistered appearance, and you will get that action all through the water-submerged part of your boiler. You will never get all your scale out with kerosene; you will never get more than a third, and those who are using kerosene and claim that it is working well simply look at the scale that they take out and do not look in the boiler to see what is left. I have traveled a good deal and some of my best friends tell me that they have used kerosene and their boilers are clean, their system is in good shape; and I have gone down to their plants, and looked around, and in the steam system, from the boilers to the engine, I have seen the little leaks; and when this leakage does start in and a flange gives out and you have to put a new one in, in taking that apart you jar the whole system and bring to sight more leaks where your piping is half-eaten through and almost ready to leak. Of course an old plant will show up leaks in a few months or a year, but a brand-new plant will disclose leaks in time, if you continually use kerosene.

Now, why do people want to use kerosene? It is generally the man up at the office end of the institution that clings to the practice; it is generally the superintendent or the manager that advocates kerosene, because, he thinks, it costs nothing; he is getting something for nothing. That is where so many men have made a mistake, even in the running of large enterprises and large businesses. One of the greatest dangers is to look for something for nothing. Even in the hiring of men to represent them, and in the hiring of help; in the hiring of brains around their establishment, they are not willing to pay; they want $10 put in their hands before they will give $8. A man cannot do that in business. You cannot get something for nothing and you cannot get any man to run his business without profit. This is true of boiler compounds. In the use of them the modern steam-plant owner is far behind all other branches of science. If you will, in using kerosene or using any volatile oil of that nature whatever, take the subject up and look into it for yourselves, you will find that the deleterious effects, the general carbonizing and pitting, the general eating away of that thin, natural skin of the iron (the thin skin of iron is once gone the scaling ingredients readily attach themselves to the rougher iron; while in the new boiler they cannot adhere as rapidly as they can in the boiler where the skin is gone.

[1] Address before the Northwestern Electrical association at Milwaukee, January 5, 1898.

Discussion.

George L. Thayer: I would like to inquire what the chemical reactions are that occur between the pure water and the iron and also between the mixture of pure water and the hydrocarbon oil and the iron. There has been a great deal of trouble with exhaust steam where the condensed water was absolutely pure, and a direct corrosive action on the iron being found, which is stronger at the pressure of 212 degrees than it is with the high pressure steam. The New York Steam District company laid its steam mains originally with return pipes and found that the returns were so badly corroded that they had to waste all the water of condensation instead of returning it to the boiler.

Mr. Edgar: It is purely an oxidation with the aid of hydrogen. We get the same effect there

as we would get in a boiler where you are using the water over and over again, and the water is too pure, or you are pumping rain-water and distilled water back into your boilers, and you get a pitting. The same is true as to the submerged part of the boiler; you get a pitting and grooving of the iron, and many of these pits have a scab or the appearance of a scab. If you tap that off you will find underneath a little raw sore, you might say, a hole, eating through the skin of the iron, a pit-hole, and in that hole you will find a red powder, and this powder is the ferric hydrate. You get the same thing by taking tincture of chloride of iron and adding ammonia water, precipitating ferric hydrate; and by boiling the same, as we would boil it in the pharmaceutical laboratory, it is converted into its oxides, finally going into black magnetic oxide of iron, which is a black, gritty powder, having the physical properties of the black manganese dioxide, and is found in the bottom of the boiler.

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In this deleterious action on the piping from the distilled water you have a water which is not satisfied. You know water is the greatest solvent known to chemistry. We have no artificial liquid or anything produced by nature that is as great a general solvent as water. It must take up something in solution to keep it satisfied.

Mr. Thayer: The water acts on the iron and produces ferric hydrate with the liberation of half the hydrogen? Is that it?

Mr. Edgar: Yes; we get direct oxidation by the way of a hydrate. Also, we often pump our fresh water into the heater and get pitting in the heater and not in the boiler, which is due to lack of circulation, and the freeing of the air and oxygen held in the water, and it is almost a direct oxidation in that case; but we get a more rapid oxidation in the presence of the pure water. It is in an unsatisfied condition, and our iron is taken up as a hydrate from that to an oxide; that is, from our analysis and personal investigations we find that we have got to satisfy the water. If you could in some way get into the condensing system, that is, into the steam system, where the condensation begins to take place, and introduce something to satisfy that water, you would stop that trouble, but I do not believe you can do that. There is no way of really reaching that.

Mr. Thayer: Hot water, then, containing the carbonate and sulphate of lime and magnesia, will not exert that action except in a modified degree?

Mr. Edgar: Yes.

Mr. Ralph: What is your idea in regard to the vegetable compounds?

Mr. Edgar: Speaking of vegetable compounds, we should use sugars and tannins only, and in this way: We find that we can take care of the carbonates of lime and magnesia with tannin extracts, and that is what we want, we do not want the extracted tannic acid.

Mr. Ralph: Well, the tannin is what these lumbermen were getting when they were getting it out of their oak and different lumbers, but when they got into the pine forest they got a resinous gum, as I understand it.

Mr. Edgar: Yes, sir. We want the tannin in the extract form and still combined and containing the [illegible] matter, the sap, the [illegible] and the starch. We want that because we do not want the straight, pure tannic acid. It is too stable in itself to be readily convertible into tannates. Our object is to convert carbonates of lime and [illegible] into tannates. Now, we find that we cannot work on gypsum, the sulphate of lime, with tannin. We find that gypsum is one of the most insoluble sulphates, and that it is so stable in itself that it is not even soluble in its own acid and is soluble only in the analytical laboratory in small quantities in [illegible] acid.

Mr. Thayer: Have you worked on the magnesium sulphate, too?

Mr. Edgar: Yes. We find that sugar introduced into the steam boiler with the water will convert the sulphates into [illegible]. The [illegible] break up the sulphate [illegible] and [illegible], and in the presence of tannin [illegible] that one into tannate of [illegible] but a small proportion of [illegible] the general mixture to handle a water containing both the sulphates and the carbonates. Your sulphates and [illegible] are to be proportioned according to the percentage of the carbonate and sulphate contained in the water, determined by analysis.

Mr. Ralph: You spoke about introducing the compound into the steam heater or condenser. Do you not think that would be a good way to neutralize the effect of the water, if possible, before it went into the boiler?

Mr. Edgar: Yes, indeed. Take it back as far as you can take it through the system. The tannins in the extracted form and blended with the sugar give you no tannic acid reaction or action on the metals. You have got your readily converted tannins and they will take up lime and magnesia only, and under the conditions it is impossible to get any effect on the iron or metal. It also has no effect whatever on the gaskets or any of the substances of an organic nature in your packing. Using a vegetable mixture of that kind, you will keep your gaskets pliable. You will keep all your connections and your boiler plant intact with never a leak, and you can keep your boilers absolutely clean, and you can go to the wholesale druggist and buy the materials yourself; and it is well always to mix in a little slippery elm and pokeroot or powdered willow hardwood pulp so as to get a little soluble wood starch, so as to keep your sugars from being too stable and the tannins, likewise, so as to get readily convertible tannates and saccharates. We should not have a thing too well satisfied—we cannot change it—the actions are not there—we are in the realm of organic chemistry, where the combinations are very complex. We get a reaction a great many times in chemistry which is not true to our general text-books; that is to say, there is many a chemist who has determined something in his laboratory and completed a reaction, and he has formed a company to exploit his new method of making white lead, for instance, at one-quarter of the price at which it has been hitherto produced. He goes right on with his work; he is perfectly sincere and confident. A big factory is put up, machinery is started and everything is set going, but the results do not come. The chemist then changes everything and perhaps puts in some electrodes with a little current for the purpose of excitation, but all fails; and there has been many a fortune lost on such laboratory results. On the other hand there are a hundred and one things that take place in our manufacturing establishments on a large scale, produced by nature, that we cannot reproduce in the analytical laboratory.

Pliny Norcross: You do not recommend, as I understand it, the use of kerosene oil to remove scale in boilers?

Mr. Edgar: No, sir; under no circumstances should kerosene oil be put in the boiler. I would make the same remark in regard to caustic soda.

Mr. Norcross: Your suggestion in regard to the skin on the iron is important.

Mr. Edgar: I would advise you to get a tube that is all scaled over and seal it up at the bottom of an iron kettle and play your flame up in the middle of it, then put your kerosene and water in there and watch the action. In relation to steam heaters, I may say that I think one of these steam heaters is a good thing on hard water, for you get from 50 to 70 per cent. out. If a water is so soft that you get all the impurities out, it becomes too pure, and you pit your boilers. In the East, where

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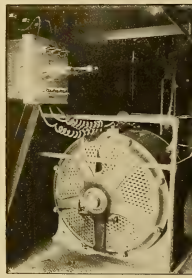
the soil is principally granitic, there is very little scale, only about two or three grains to the gallon, but throughout the West, where there is a limestone soil, you get from 16 to 40 grains. A surface blow-off contrivance is very good, but the trouble is that it is expected to do all the work, and sufficient interest and care are not usually taken in the application of such contrivances. The boiler is too often neglected, and it cannot get up and speak its piece like the engine when anything is wrong. You must diagnose your case and work out your own ideas. Do not forget to treat the boiler regularly. Put in whatever you use regularly. Have the water analyzed and go to the wholesale druggist and he can mix up the tannins and sugars in proper proportions; but do not use any soda. Some sulphate waters require considerable starch, slippery elm, etc.; they sometimes use five or six per cent. of carbonate of soda in boiling it together, which kills the gelatinous properties, then when you introduce your tannin extract the carbonate is converted into tannate of soda; five per cent. tannate of soda, 20 per cent. of sugar and 50 per cent. of tannins. The steam users in the country should look into this thing and should study their boilers.

Electrical Shop Transmission.[1]

By H. G. Dimick.

Under this title all the various kinds of electrical transmission might be classed, but it is not the intention to burden you with such an exhaustless subject. This paper will be confined largely to a



ELECTRICAL OPERATION OF A GREAT GRAIN ELEVATOR.— ONE OF THE 100 HORSE POWER TOWER MOTORS.

plain two-wire 220-volt system, and motors belted to line shafting in the various departments of the shop in question. The other systems used to some extent are 220-volt three-wire, the 500-volt direct current and the alternating current.

Besides connecting motors to line shafting, there is another practice which is used to some extent, that is, connecting the motors direct to each machine requiring power, doing away with all line shafting and countershafts. This method may be the most economical as regards the amount of power used, especially where the machines thus connected are not run constantly. There is more or less of this class of machinery in all factories. But the first cost of such a system is something which bars it in most cases unless the machines require not less than five horse power units to drive them; then the extra-cost question will not become so great, since motors can be purchased at an average price per horse power.

The two cases which generally come under the engineer's charge are: First, the changing from the old belt or rope drive to motor drive; second, the equipment of entirely new shops and machinery with motors. The writer would prefer the latter, after his experience with the former. The first is to be met with most frequently from the natural condition of our industrial and manufacturing world. When changing from the old rope drive to motors, it is very desirable, and sometimes even necessary, that the change should be made with little or no loss of time in operating the factory. This offers the chance for considerable ingenuity and engineering on the part of the electrician and millwrights, for they seldom find the conditions the same for any two cases. The above-mentioned difficulty, coupled with the extra trouble of having to go around old fixtures with the wiring, and locating centers of distribution, fuse cut-outs, starting apparatus, etc., makes it more difficult and expensive to install such a system than to start in with everything new. But it is sometimes still more difficult to convince the owners of this fact until they have paid the bills.

The laying out of such a plant or system requires considerable time, attention, ability and arranging of details before the real work can be done, such as the location of cables, motors, starting outfits, centers of distribution, fuse cut-outs or branch blocks, measurement of distances, etc. After all this has been done one still has the great question to decide, "How much power does each department require? What will be the minimum, maximum and average loads, and how much shall be allowed for growth or enlargement in future equipment?" In many cases he must make assumptions for these and go ahead. When these are decided one can lay out his power plant and determine the size of the generator. Here the writer can only reiterate what is practiced in all modern power plants. Put in as large units as possible and have at least one reserve machine, especially where the plant is kept running 24 hours per day. It will also be found practical to have one small unit of 50 or 100 kilowatts to run in cases of very small load, and for

1. Read before the Chicago Electrical association, January 7 1898.

extra overtime work. Of the other details of the power plant, such as boilers, fuel, pumps, condensers, feed-water heaters, steam and exhaust piping, engine regulation and economy, constant voltage, recorded daily load, efficiency, switchboard, etc., little need be said, as most engineers are familiar with such specifications already, and know what they would specify if the opportunity offer. The changing from an old equipment which is partly electrical and partly rope-driven opens another valuable field for designing temporary apparatus with the least expense, and this will be found quite difficult when one has two or three thousand amperes to collect and distribute on a dozen or more circuits. The methods of accomplishing this may be numerous, but the means used are generally indescribable. Those who have done such work would rather have it remain undescribed than to give a very exact description of its appearance.

Before describing any apparatus, the writer wishes to say that it is, or was, much easier to get out of difficulties by being in a place where they could design and manufacture just what was asked for, than to be in a position where one could only get what was on the open market, especially if that market be four or five hundred miles away, and material had to be shipped from there.

The switchboard should contain the usual outfit for the generators and circuits, such as fuses, main switches, with or without equalizer blades, circuit breakers, single or double-pole field switches, rheostats and ammeters, a voltmeter for the bus-bars, and one for a combination switch whereby all the machines may be connected with it when they are to be thrown in parallel. A recording ammeter or wattmeter in series with the bus-bars is also a

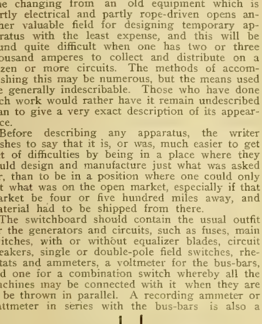


FIG. 1. ELECTRICAL SHOP TRANSMISSION.

useful adjunct if it records correctly, as is also a recording voltmeter. The distributing switches should be fully equal to their rated capacity, for times will come when it will be well that they are large. An ammeter in each circuit is also desirable, as it will save many future tests; then there should be suitable provision for a ground test through the voltmeter. This is sometimes accomplished through the regular combination voltmeter switch. A good supply of pilot lamps will also save much guess-work in operating a board.

The methods of connection on the board may be varied somewhat, but they must conform to plans already well known to most of us. For connections from generators to board, good lead-covered insulated cable should be used and run under the floor. It will be found much easier and convenient to use cables of not over 800,000 circular mils cross-section, for, if the unit is a large one, two, three or four of these may be run in parallel for each side of the circuit, and the work can be done in less time and less copper used than when one large conductor is used. The same can also be said of running large feeder circuits to various points.

Now for distribution from the board. Having the load at the different points, and the distances, the next question is to determine the drop and size of cable to produce that drop; then the kind of cable; and when we say cable, we mean stranded conductors, of which there are practically two kinds in use to-day—the rubber-covered and lead-pipe-covered, the insulation of which may be rubber or other material. There are numerous ways of putting up large feeders, chief of which are on glass or on porcelain insulators, on special clamps, in iron-armored conduit and lead-covered cables in plain iron pipe. The latter two methods are by far the best as well as the most expensive, which is as it should be. The only objection worthy of note is that one cannot tap into a circuit as neatly and as cheaply as in exposed work, while the chief advantages are that the cable will always be insured against injury and abrasion. The cables will stay in place and not be liable to be broken down, and the unsightly sags and loops are once for all eliminated. Having the cables in, the next step is to properly seal or solder the terminals. With rubber-covered cables this is comparatively easy, for they can or should be soldered or clamped directly into the fixtures. These should be made to fit them, for they seldom do fit unless made after one has the cable to go by. With lead-covered cables whose insulation is not filled with air and water-tight compounds, an extra large lead sleeve must be wiped on the end of the cable and filled with some compound which will not melt and run out on account of the heating from heavy loads or short-circuits on the line, when the sleeve points downward or horizontal. We have yet to see the ideal method of dealing with this case.

We are now ready for the sub-dividing apparatus, and a good method for this requires that there should be a switch and plug fuse for each motor circuit on each floor at the point of junction with the main risers or feeders, but it costs money to do this, and we can dispense with the switches but not the plug fuses, although plants have been put in, and many of them, with nothing but plain fuse branch blocks. Whether the first or second plan is adopted, a small distributing board may be designed with a uniform plan for any number of circuits desired, and much time will be saved afterward by its use. The diagram of the first-named board is shown in Fig 1. Another branch block, which can be used in rooms at the ends of sub-feeders from the boards just described, was very useful where more than one motor was required. In diagram it looks like Fig. 2. It is on a slate base, very durable and not expensive, considering the number of outlets. It was fitted for plain fuses, but it should have a plug switch or fuse and a fireproof cover, according to rules. When rules are mentioned, of course we all know what rules, and a word in regard to their use may not be out of the way. The writer had one of their books, and could tell nearly everything in it, and also knew of several established uses and customs among the inspectors, but he had at the very least a hundred and one cases where he had no rules to go by and had to go ahead and use his own judgment or send over to the city hall and wait a week or two before he could get an answer and proceed with his work.

We are now to the motor-starting apparatus. This should be uniform in style for the whole system; and to accomplish this, individual motor-starting switchboards should be built of uniform size on slate or similar material. The following-named apparatus should be placed upon it: A switch, a fuse, a starting box or rheostat, pilot lamps and an ammeter. The last is not absolutely essential, but it enables one to see quickly if the motor is overloaded, and it is worth the extra cost. The arrangement, design and connections of this board can be left to the person in charge to suit himself, and he cannot make a very serious mistake in it. The principal part of this outfit is the starting-box or rheostat. It has been mentioned in an older paper and it will bear repetition here: "In the first place put in a motor that is large enough to do the work without straining it or overloading it. In the second place, secure a good automatic starting rheostat. On these two points hinge the success of motor transmission."

When we take into consideration that we have from 100 to 150 motors in operation, and as many starting boxes, and if the circuit breakers open on the generator all these rheostats must automatically return to "starting point," we see how perfect our rheostat should be, and the writer has yet to see the rheostat that will always do it. Some attendant will have his switching lever tied up or tied down, whichever the case may be, and there will be a chance for an armature burn-out when the current is turned on again. The writer has had experience with three or four different makes that are on the market, and they are all subject to all sorts of trouble. Some of the old style starting equipments whose rheostats were not automatic but operated by hand are all right, but the risk of burn-outs and the fact of one plain, perfectly understood rule in the underwriters' book compel us to drop their use for "would-be" automatic ones. An automatic rheostat means one which will open the armature circuit automatically whenever the current ceases to flow from any cause whatever, and makes it impossible to start again without first having all the resistance in circuit. Lately this has come to include overloads also, which means another contrivance similar to a circuit breaker on each rheostat. The principal specifications for a good automatic starting rheostat should be something like this: It should be thoroughly fireproof, the different steps of resistance should be properly proportioned to avoid injurious sparking at the switching segments and allowing too great a difference of current to flow in the armature before it is up to speed; the switching segments should be comparatively large and massive; the contact arm should be easy to work and the contact piece itself should be the point of wear and tear, easily removable and cheap. The segments and the moving contact should be kept clean and free from all burned spots by the attendant, otherwise the rheostat will be out of order in a short time, and this is the owner's part to perform. The automatic part usually consists of a magnet holding the contact lever in the position where the resistance is all out, and when the circuit is opened, from any cause, this magnet releases the lever and a spring or gravity throws it back to the starting position. Another magnet or the same one performs a similar function when an overload comes on the motor. These magnets are connected in series with the field, in series with the armature, or across the feeder terminals. The two most common troubles are the failure of the automatic to work when it should, or it works when it should not, and the burning of the switching segments or contact. The minor troubles are the burning out of the resistance coils or magnet spools, breaking of springs, loosening of screws, overheated contacts, and many other little things that will get out of order. No one can appreciate all the troubles that will arise until he has the care of a hundred or more of them of varying sizes and diversity of manufacture for a few months. He will find all the troubles enumerated and more. Therefore a boom, financial and electrical, awaits the man who will design and manufacture for sale automatic starting rheostats that will run all sizes of motors equally well, and be without half of the troubles already mentioned.

And now a few words in regard to the requirements of the motor. The principal thing to consider is the kind of work it has to do, that is, whether it is to have a steady load all the time, or if it is to run a heavy load for a few hours and then at half load the balance of the time, or whether it is continually changing from almost no load to full or overload every few moments, and whether it is reversed very often and quickly. Then we must determine if possible from figures, comparison or otherwise, the real full load and average load in horse power. For the first class of work spoken of, get a motor whose rated capacity is about 10 per cent. more than the load expected

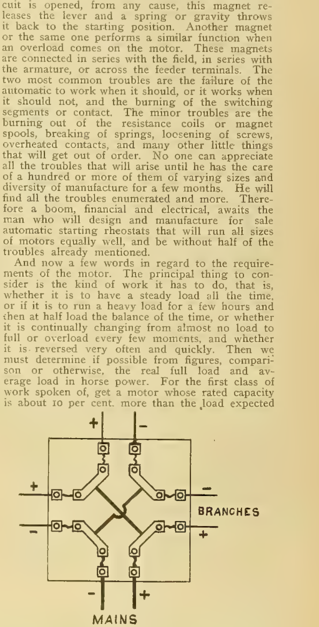


FIG. 2. ELECTRICAL SHOP TRANSMIISION.

to be put on it. For the second kind of duty spoken of, get one whose rating is about 15 per cent. more than the load. For the third class of duty, get a motor whose rating is 20 to 25 per cent. larger than the load to be handled. Of course the value of these ratings depends very largely on the style of motor and the manufacturer's method of design. The writer believes in putting in motors by this rating, even if it does cost a little more and a little is lost in efficiency, for the motors will be heavier, run slower, run cool without injurious heating, and the coils, brushes and commutators will last longer. The item of commutators is no small one, when one takes into consideration the price of a new one and the time of waiting for it to be put on. Another reason why large motors should be put in is that in large manufactories there is always room made to put in a few more machines to be driven. Although one may believe he has figured in everything possible at the beginning, somehow they always manage to put in more machinery requiring power, and all concerned are better satisfied if the motor already in is able to carry the load without working on an overload. This will hold true in nine cases out of every ten.

In conclusion, when the plant is once completed and has been running a few weeks, one will begin to see whether his calculations as regards the power required have been true, and small changes will need to be made to fit abnormal conditions that he could not foresee. A series of tests should be made on all points where there is a possible chance for betterment, such as the voltage, belt friction, line-shaft friction, etc. Apparatus can be arranged cheaply to test the amount of power consumed by each separate machine, so that one will know just what each machine consumes in doing its work and thereby add to the cost of the article the cost of the power required to produce it. Of course this means a little expense, but we must have our electrician around, and we must have something for him to do, so that both parties concerned will be prepared with the experience for future operations.

Robert Nichol of Millbank, S. D., contemplates putting in an electric light plant.

Western Electrician.

EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Thomas Jansen, being duly sworn, deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the foreman of the printing department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the printing of No. 24 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were printed by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified. And further this affiant sayeth not.

THOMAS JANSEN.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES, Notary Public.

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One interesting feature of Mr. Dimick's paper on "Electrical Shop Transmission," given in this issue of the Western Electrician, is his assertion that, after exhaustive trial, he has yet to find an automatic starting rheostat for motors that is entirely reliable and that can be safely counted as "automatic" in emergency. His experience is probably no different from that of other engineers of motor-driven plants, and yet it is to be noted that manufacturers of these devices, as stated elsewhere in this number, have again reduced their prices, which have now reached a point which seems to prohibit the turning out of a first-class product at a fair profit. The competition seems to have brought out the motto, "Not how good, but how cheap." This is not a healthy state of affairs for any branch of the electrical industry.

There seems to be no reasonable ground for objection to the new Department of Electricity which has been created by the City Council of Chicago. The new law takes the general electrical interests of the city government out of the Fire Department, where they did not belong, and puts them in charge of a distinct branch of the municipal administration on a plane of equality with the other great departments of the city government, such as fire, police, public works, and the like. This is a just recognition of the importance of the electrical development in Chicago; in this city, at least, the industry has discarded its swaddling-clothes. The actual operation of the department will show little change from that of the old bureau, only there will be greater freedom of initiative in planning and supervising the work to be done. Undoubtedly the men now in charge of affairs will be retained with new titles; and on all accounts the change seems a desirable one. We congratulate Mr. Ellicott and his associates.

Experience proves that the best possible construction of overhead wires is at times severely tested, and where inferior work is done the loss occasioned by wind, snow and sleet oftentimes cripples operating companies. Chicago was a storm center during the early part of the week, and in many parts of the city wires were down, poles were snapped off like pipe-stems and telegraphic, telephonic, railway, light and power service suspended temporarily. Aside from the danger from falling wires the inconvenience to the public is very great, and the company that passes through such an ordeal without subjecting its patrons to delay and discomfort deserves recognition and remembrance. It is, of course, sometimes impossible to withstand the fury of the elements, but in such cases allowance must be made. The storm just passed proved exceptionally trying upon the electrical companies of the city, and much more so upon the corporations whose wires extended beyond the city limits, as they were there exposed much more than in the city.

Advocates of governmental ownership of the telegraph must experience considerable pain these days because of the attitude of the Postoffice Department upon the subject of deficiency. It is the firm conviction of those who would make the telegraph system a governmental institution that the benefits of this modern method of communication should be placed at the disposal of backwoodsmen as well as city chaps. Of course the former may not, and probably will not, need it, at any rate they do not seem to be suffering because they are deprived of it, but the modern socialist insists upon giving it to them whether they want it or not and without regard to expense. That can be met along with other deficiencies. But the present administration does not appear to fancy the policy of increasing the deficiency in the Postoffice Department each year, and accordingly the word has been passed to cut down expenses. This, of course, can only be done at the expense of the service, but it is deemed unwise to continue the present course. Existing conditions, it would seem, preclude the possibility, therefore, of the government telegraph scheme receiving serious attention for some time to come.

Joliet has granted the local street-railway company a 50-year extension of the term of its franchises, under the Allen law passed by the last Illinois Legislature. The extension ordinance contains no compensation clause, and the action of the council has consequently aroused much unfavorable comment. It recalls the experience of the same city in conferring valuable privileges under similar conditions. It is claimed that not long ago the aldermen got up some speculative gas and telephone ordinances and put them through the council despite popular protest. There was no compensating feature in these ordinances. They were in the name of a "prominent citizen." This prominent citizen, however, seems to have political ambitions, and he did not relish the criticism that his action brought upon him. Consequently he took the public into his confidence and gave to the city, for library and hospital purposes, the $40,000 which he said he had realized from the sale of the ordinances. No attempt was made to construct plants under the authority conferred by them. It is hardly to be expected, however, that the street-railway company will follow the example of the "prominent citizen" alluded to.

With great persistency, middle-class Englishmen cling to the idea that it is the fault of the British workingmen, with their demand for shorter hours and their trade-union restrictions of shop output, that is causing the steady loss of trade to the manufacturers of Great Britain. The additional explanation, so patent to observers of other nationalities, that the trouble is largely with the manufacturers themselves, who are conspicuously trade egotists, entertaining the delusion that an English tool or machine or method of doing business of 30 years ago is better than one of any other country of to-day—this reason for the existing state of affairs is overlooked with dogged pertinacity.

As to the cause of the decline of the British export trade in machinery, the English are blind because they will not see. It is too much to admit national inferiority in any degree or particular, and with great haste and unanimity they fasten all the blame on the poor mechanic. The latter, no doubt, is unreasonable and perhaps blind to his own best interests in stubborn insistence on requirements about piece work, apprentices, hours of labor and the use of machines that seriously cramp the employer in competition. Still it should not lie in the pot to call the kettle black, and the manufacturer is certainly just as stubbornly English in refusing to learn from competitors who, in many lines, do better work, who adapt themselves more quickly to changed conditions of demand, and who are alert to inform themselves of the latest advances in industrial development and to make practical use of their knowledge. The English are fine machine builders, but they are encumbered by some foolish prejudices which handicap their great strength as an industrial people.

These reflections occur to one on reading a letter to the London Times by a Mr. R. Percy Sellon. This gentleman reviews the situation to combat the "unsound economic doctrines on the part of British trade unions." He restates the old indictment against the workmen, with a touch of the customary British buncombe about "the country on whom rested the blessings of free trade, industrial experience, world-wide commercial relations and unparalleled imperial and colonial possessions." But, considering the electrical manufacturing business, which was started on a level footing in all the great nations about twenty years ago, he finds that "both American and continental electrical manufacturers are underselling British-made goods in the neutral markets of the world, * * * and are to-day threatening, particularly in the respects of electric traction and power plant, to introduce ruinous competition in our home market itself." As we have pointed out, the Englishman wrapped himself in the egotistic delusion of unquestioned superiority and lagged behind the times. Now he wonders how it has come to pass that his international rivals are getting the business that he thinks should be his. Mr. Sellon states that "the capital invested in the electrical plant manufacturing industry in Great Britain has been estimated at not exceeding £4,000,000 to £5,000,000, in Germany at £10,000,000 to £12,000,000, and in the United States at £25,000,000 to £30,000,000. The output of manufactured electrical goods must be substantially in proportion." The writer thinks that the explanation of this disparity "undoubtedly lies in the conditions on which labor is obtainable." He overlooks the fatal and prejudiced conservatism of the manufacturing interest in England. The interest of his letter to Americans lies in the fact and in the statements of fact which we have quoted.

Death of O. B. Shallenberger.

O. B. Shallenberger is dead. At about 8 o'clock on the evening of January 24th, after an illness of several weeks, he passed tranquilly away.

Oliver Blackburn Shallenberger was born at Rochester, Pa., in 1860. At the age of 17 he entered the United States Naval Academy as a cadet, and from the start he took a leading position in his class, displaying even then that remarkable judgment which was such a large factor in his success. About that time Prof. N. M. Terry had begun to develop that excellent course in physics which has added so much to the reputation of the Naval Academy, and Mr. Shallenberger had no sooner entered upon that study than he began to take a special interest in the branch of electricity. His inclination from the first was toward original and experimental work. Mr. Shallenberger's course at the Naval Academy was contemporary with that of Duncan, Sprague, Hasson, Wilkes and several others whose names are well known among electricians. After the graduation in 1881, he made a cruise in the Mediterranean, returned to the United States in 1883 and resigned from the naval service the following year in order to give his whole attention to the science of electricity.

In 1884 he became connected with the Union Switch and Signal company of Pittsburg, as assistant in its newly organized electric-light department. His ability soon became apparent, and the following summer he was selected to take charge of the setting up and operation of the Gaulard & Gibbs apparatus, imported from Europe by Mr. Westinghouse, at which time his personal acquaintance with alternating currents began. After Stanley's experiments at Great Barrington, Mass., and other experiments conducted at Pittsburg by Mr. Shallenberger, the alternating-current system was adopted, the Westinghouse company was organized and Mr. Shallenberger was appointed chief electrician.

Mr. Shallenberger was one of the earliest to apply the theories then known about alternating currents to practical operation. It is said that he was the first one in America to succeed in coupling alternating-current generators in multiple. The system used for incandescent street lamps in series, with a shunt of high self-induction around each lamp, was one of his early inventions. Probably his most beautiful conceptions are exhibited in his electric-measuring instruments.

In 1891 Mr. Shallenberger was obliged to go to Colorado Springs on account of ill health, where he has since spent his winters, returning East to his home and laboratory in Rochester only during the summer months. During this visit last year Mr. Shallenberger organized the Colorado Electric Power company. He was the president of the company and acted as consulting engineer for the Westinghouse Electric and Manufacturing company.

It may truly be said that with the name of Shallenberger left out the history of practical electricity cannot be written. In view of what he accomplished in the short space of 38 years, the query is suggested what further inventions and discoveries might still have come from such a rare and enviable intellect, had he been spared and health given him. His death will be considered a personal loss by all who have been associated with him, and little less by the fraternity generally.

Topics of Interest to Central-station Men.[1]

By F. B. Badt.

When I got to Milwaukee yesterday, I found to my surprise that my name was on the programme for an address on the subject of "Topics of Interest to Central-station Men," although, as a matter of fact, I had simply asked for the privilege of saying a few words extemporaneously, to get acquainted with you, as this is my first appearance before this body.

For the last four years I have advocated the 220-volt direct-current system, and tried to get lamp manufacturers to furnish 220-volt lamps. At first they all declared that it could not be done, the thing was not practicable, it would not pay them, and they wanted to know how many lamps we could order, and many other similar questions were asked; in short, we had almost to coerce them into making us 220-volt lamps, but I find to-day, looking over the electrical papers, and I feel very good over it, that many manufacturers advertise 220-volt lamps as a specialty. In other words, the 220-volt lamp has become a commercial article.

The advantages of the direct-current 220-volt system are many. You all know that the Edison three-wire system which was recommended by Mr. Dow yesterday, expires, if my memory does not fail me, in the spring of 1901; and it was one of the main reasons of getting a direct 220-volt system, to avoid infringing on the Edison three-wire patent. Of course a straight 220-volt system is really simpler than the Edison three-wire system, necessitating only one dynamo, doing away with the neutral wire, with balancing devices to keep the two sides of the three-wire system at proper voltages, etc. Now, setting aside the patent question entirely, a 220-volt system is much more easily managed than a three-wire system. It costs less to install it, and it costs less to maintain it, if proper caution is used. We have to-day, as I stated before, 220-volt incandescent lamps, and within the last few months an arc lamp has been developed, not by one company, but by a number of companies, an enclosed arc lamp which will burn singly across 220 volts. You all know that a 220-volt direct-current motor has many advantages over a 120-volt motor, so we may say that in the 220-volt direct-current system we have a good system for small central stations where moderate distances are to be met, say three-fourths of a mile radius from the station. The 220-volt arc lamp is probably known to many of you. It is a lamp which at nominal 2,000 candle power uses 2½ amperes at about 160 volts in the arc. The arc is three-fourths of an inch long. Of course the advantage of such a lamp over running two or three lamps in series is evident. You can supply a customer with one lamp without making that lamp depend upon somebody else's lamp, and do away with all series connections. You have a lamp which practically casts no shadow. I think that such a combination of 220-volt lamps, 220-volt arcs and 220-volt motors, presents a very simple system, and a system which I think properly operated will likewise earn money.

For isolated plants the 220-volt system will, of course, only be used where there is a good deal of motor service. Now take the elevator service which Mr. Dow mentioned as probably the severest service that can be had; the 220-volt arc has again the great advantage that great fluctuations in the power circuit will not be noticeable in the arc. You take an arc of 160 volts difference of potential, three-quarters of an inch long, and it will practically not be affected by a variation in the power circuit of, say, 50 volts. Now there again is an advantage even in an Edison three-wire system of the 220-volt arc against two 100-volt arcs. In the Edison three-wire system of course the fluctuations on each side will

O. B. SHALLENBERGER

be greater than the fluctuations of electromotive force on the outside wires. The balancing requires some attention, and often it happens that one side has more electromotive force than the other. Now if the electromotive force of the outside wire is kept fairly steady, you get, of course, less variations there than on either side, and a 220-volt arc will give better satisfaction.

The enclosed arc lamp itself has made great strides during the last few months toward perfection. Our friends on the other side of the water have declared time and again, and have proven it to us mathematically, that the enclosed arc is no good; that the open arc is of greater efficiency, and has many advantages over the enclosed arc; but in spite of those theoretical demonstrations, the enclosed arc is the lamp of to-day in the United States, and the open arc for constant-potential circuits is getting out of vogue entirely. It is a back number and illustrates where theory and practice do not coincide. The American is, if anything, practical, and if the great public here decides that the enclosed arc is the thing they want, it is the thing they must have in spite of theory and efficiency or anything else. I think that it will not be very long when we will have an enclosed arc of 500 volts to be connected directly across the wires of a railway circuit. Now, there again such an arc will have great advantages over the old method of running from five to 10 lamps in series, one lamp depending on the other, making the mechanism more complicated on account of cut-outs, extra resistance, etc.; and again, an arc of, say, 450 volts difference of potential, will stand great fluctuations. Now the fluctuations in the railway circuit may be 100 volts or more, and while an arc of 450 volts will stand that, five or 10 lamps in series will be seriously affected by such fluctuations. I think the solution of the question of a good practical lamp —never mind the efficiency—for railway circuits will be found in the enclosed arc lamp burning across 500 volts.

There is another little matter that I should like to mention in connection with the enclosed arc lamps, and that is the gas-cap, as it is usually called; that is to say, the cover for the inside cylinder through which the upper carbon passes. That gas-cap has got to have an opening, of course, through which the carbon passes. Now most of the enclosed arc lamps use what is commercially called a half-inch carbon. I have calipered a hundred of them and find that they vary from .025 inch below to .025 inch above the standard half-inch. You can easily see that one of the requirements of an enclosed arc lamp is to have the carbon fit as tightly through the hole as possible, to prevent the outside air getting into the cylinder. Now if the carbon is a little too large it will stick; again, if the carbon is too small, too much air will follow into the opening and the lamp won't last the guaranteed lifetime, 100, 150, or 170 hours, whatever it may be.

Now I have also found that the different manufacturers of enclosed arc lamps—I think there are about 20 in the United States now—have not adopted the same diameter for the opening of the gas-cap. The diameters vary from exactly half an inch to about .018 inch above half an inch. Now taking that in connection with the variations in the diameters of carbons, and you can see that a man who has a few hundred enclosed arc lamps, or less, and buys carbons indiscriminately without ascertaining the diameter, may have considerable trouble; and I would suggest that this association take up the subject of standardizing the diameter of the hole in the gas-cap and urge the manufacturers of enclosed arc lamps to adopt one standard. If that is adopted, then, of course, the carbon manufacturers could be compelled to furnish carbons within certain limits.

Of course it is impossible to have all carbons absolutely of the same diameter, because there is more of less shrinkage in the baking, but we could get so near to that standard that all the trouble that they exist now would be avoided. All this refers to the direct-current system, of course.

Now, as to the alternating system, my opinion is that the single-phase system will eventually be the system. It recommends itself for its simplicity, and I think it will not be long now before we have any number of different makes of single-phase motors in the market. We have now, of course, incandescent lamps operated on alternating currents; we have alternating arc lamps; we have finally gotten a few alternating enclosed arc lamps that are good and give a life of about 100 hours with one trimming of 12-inch carbons, and if we have the single-phase motor, I think we will have the system for stations that cannot avail themselves of the advantages of the direct-current system; in other words, where conditions are such that you have to cover large areas and have to use high-tension primaries and low-tension secondaries.

Mr. Dow yesterday mentioned one objection to alternating systems, namely, that each customer had to have a transformer for the motor capacity of the dwelling or whatever it might be, and he cited that as a great disadvantage of the alternating system as against the direct-current system. Now, I think that a good deal of that could be avoided in the alternating system by using larger transformers for a number of customers. Of course you could not do it economically with 50-volt lamps; you might not be able to do it economically with 110-volt lamps; but why not use 220-volt lamps? There again, I think, is a new field for the 220-volt lamp. Use large transformers, take one transformer, if possible, for a block, and then wire the block on the 220-volt system and use group distribution, so that you get efficiency out of your transformer, and that will avoid the necessity of using a large number of small transformers, which, of course, means a good deal of money invested, low efficiency, etc.

Before I close I should like to draw your attention to something that is not exactly electrical, but in which we are all interested, and that is the steam engine. You probably are aware of the fact that the best type of modern stationary steam engine only yields us power equivalent to, say, about 13 per cent. of the energy which we find in good steam coal; in other words, there is 87 per cent. left for improvement. Compare, for instance, with this the dynamo, where manufacturers guarantee 95 and 96 per cent. efficiency, and you see that we have not progressed very much, as far as efficiency goes, in steam engines for a century. Now, the heat engine of the future will have a better efficiency, of course. It will do away entirely with boilers. It will be a heat engine that burns the fuel (no explosions), either powdered coaldust or oil, in the engine. I am not guessing when I say that I am going to see an engine which is now on exhibition on the other side of the water, and I know that a number of American capitalists are over there now trying to buy the patents. That will be the steam engine of the future. It will be an engine without boilers, gentlemen, and no explosions, as in the gas engine, but burning fuel in the engine and utilizing it for power. Now you can all figure out for yourselves what a revolution in steam engineering such an engine would produce.

One of our great street-railway magnates in Chicago has made the ridiculous statement that his franchises will last forever, no matter what the city government may do, or the laws may be. They may last as long as the present power is any good, but just as soon as we can do away with tracks in the streets and employ modern means of transportation these franchises are worth a nickel. The American city of the future, in my estimation, is to be a city without street-car tracks, with streets well paved with asphaltum or something similar, and motor cycles and motor buses passing in all directions on those pavements, and I think that the new engine will help us to realize this ideal. If we have the engine, as described before, we can make a locomotive that will do all that I have just stated

[1] Address delivered before the Southwestern Electrical and Gas Association, Milwaukee, January 26, 1898.

Electrically Driven Printing Establishment.

One of the largest and most complete electrically driven printing plants in the West is the new one of the Germania Publishing company, Milwaukee, Wis. This plant is operated entirely by electricity, all presses, book-binding machinery, elevators, ventilating fans and all other machinery of the plant being equipped with individual motors designed and built by the Northern Electrical Manufacturing company of Madison, Wis., which is

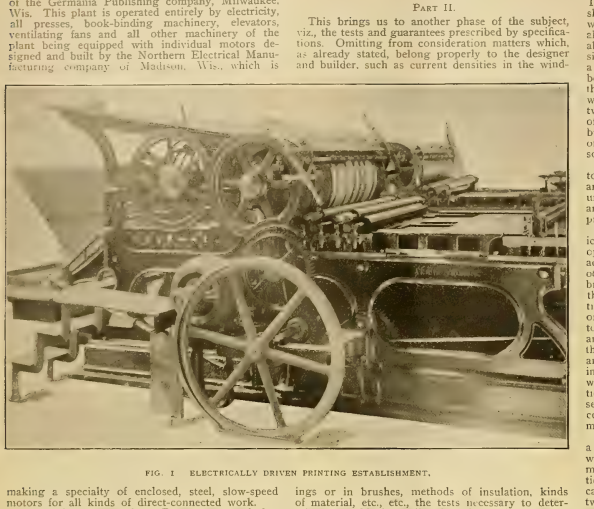


FIG. 1 ELECTRICALLY DRIVEN PRINTING ESTABLISHMENT.

making a specialty of enclosed, steel, slow-speed motors for all kinds of direct-connected work.

Fig. 1 shows one of 10 Potter two-revolution printing presses, each of which is driven by a "Northern" motor fastened directly to the frame of the press and driving the press by means of one enclosed gear of sufficient size to admit of very easy operation of the press. The motors are designed to run at a variety of speeds and to reverse at will. The system of control is such that a small lever at each side of the press, located near the feeding table, convenient for the hand of the operator, admits of complete control of the motor from either side of the press, the operator not being required to move one step from any position of work to reach his lever to change the speed, stop or reverse the machinery.

In Fig. 2 is shown one of the large Seymour inserter presses operated by a "Northern" motor geared to main drive shaft of the press, the variation of speed being effected through a controller located in front of the machine. A side rear view of this press, showing a device perfected by the Northern company for elevating and setting the large rolls of paper in their place, is given in Fig. 3. The paper hoist is operated by a motor-driven mechanism, an inverted "Northern" motor being suspended from ceiling.

These presses and equipments are used in printing the daily and weekly issues of seven of the leading German new-papers published in the West: Germania, Milwaukee; Deutsche Warte, Chicago; Deutsches Volksblatt, Buffalo; Haus- und Bauern freund, Milwaukee; Erholungsstunden, Chicago; Germania und Abend Post, Milwaukee, and Germania und Sonntags Post, Milwaukee. The Germania company point with much pride to the fact that it has now been in operation a year with its new electric plant, and has not had a single press disabled nor a single issue of its papers delayed in any way, so exacting is newspaper.

There are three elevators in this building, two of which are operated electrically by two direct-connected "Northern" motors.

A "Northern" direct-connected generator, driven by an upright engine, is placed in the basement of the Germania building, is shown in Fig. 4. The Northern company now has upon the market 20 different sizes of generators, in belted and direct-connected types, up to and including 200-kilowatts, making a line of direct-current motors and generators one of the most complete to be found upon the American market.

Oconto wire is used throughout the plant. It was furnished by the Crocker Electric company.

Carbons Wanted.

The Electrical Department of the city of Chicago is in the market for 1,000,000 carbons for arc lamps. Solid carbons, five-eighths inch in diameter and 13 inches long, are needed. The city electrician, Edward P. Ellicott, can give further information.

The Relations between the Customer, Consulting Engineer and the Electrical Manufacturer.

By S. Dana Greene.

Part II.

This brings us to another phase of the subject, viz., the tests and guarantees prescribed by specifications. Omitting from consideration matters which, as already stated, belong properly to the designer and builder, such as current densities in the windings or in brushes, methods of insulation, kinds of material, etc., etc., the tests necessary to determine a machine's quality (and hence its value to the purchaser) are few in number and can be enumerated under the headings of efficiency, heating, regulation, sparking and insulation. If the requirements under these five headings were formulated under some general rules, and if the methods of tests to determine results were uniform, the work of the consulting engineer and the manufacturer would be vastly lessened. Such, unfortunately, is not the case, and specifications on these points vary widely both as to requirements and as to the method of test. It seems practically impossible for the various manufacturers and consulting engineers to standardize these requirements and tests by any concerted action, and the only other solution of the difficulty is for some scientific, non partisan organization to undertake the work. The American Institute of Electrical Engineers is just such a body, and it would render a great service to the entire electrical business if it would consider the matter. Without attempting in any way to suggest what action it should take, it seems proper to call attention to some of the points which most frequently give rise to misunderstandings and disputes.

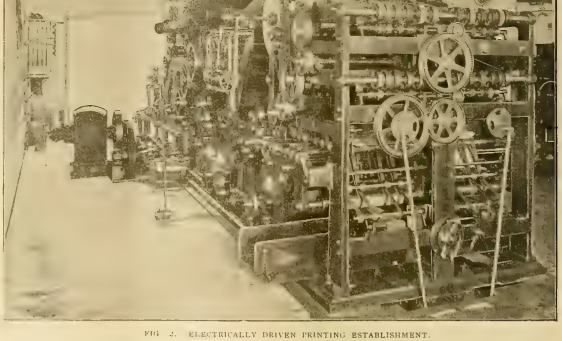


FIG. 2. ELECTRICALLY DRIVEN PRINTING ESTABLISHMENT.

1. Efficiency.—The proper distinction between electrical and commercial efficiency is not made. The latter is what interests the purchaser and it should always be specified. A clear statement of what losses must be included to determine it, and also a general statement of what constitute reasonable and proper commercial efficiencies in well-designed machines, would be of great service. Such a statement should show the necessary difference between carbon and copper brushes, and between the voltages most commonly used in direct-current work, viz., 125, 250 and 500 volts, as well as between machines of various sizes. The formulation of such information on alternators is more difficult, but all manufacturers have certain standard lines of these machines, and it is quite possible to make some intelligent general rules.

Electrical manufacturers are sometimes required to guarantee the combined efficiency of generator and engine (or other prime mover). This is clearly unfair and shifts the direct responsibility of guarantee from the maker of the prime mover, where it properly belongs.

2. Heating.—For all ordinary conditions of service, the safe heating limits for continuous full-load operation can be determined with a fair degree of accuracy. The commutator heats more than any other part of the machine, particularly with carbon brushes, a fact which is often ignored. Sometimes the heating is measured by thermometer, sometimes by increase in resistance. There should be one uniform method followed. Overload guarantees (ranging from 25 per cent. to 100 per cent.) are sometimes required for a period within which the ultimate temperature of the machine is reached, and the necessary capacity of the machine is thus increased as certainly as though a larger machine were specified. It would seem that the time duration of overload tests should bear some relation to service conditions. If the service requires a 50 per cent. overload for eight hours or more, a larger machine is evidently necessary.

3. Regulation.—Specifications frequently call for a straight line compounding curve, a condition which is practically impossible until we discover a magnetic material which has a straight line saturation curve. Another common requirement in the case of lighting generators is that a drop of, say, two per cent. in speed shall not affect the electromotive force more than two volts, which is also an impossible condition, even with a separately excited generator. A reasonable margin in either case, having due regard to the service for which the generator is intended, should always be allowed.

4. Sparking.—Modern design and the use of carbon brushes have greatly reduced the trouble from sparking, but machines are sometimes called upon to stand excessive overloads without sparking, which can be accomplished only by using a larger machine or by the distortion of design, which is bad practice. Any good machine, with carbon brushes, should be able to stand a variation from no load to full load without movement of brushes and without noticeable sparking; it should also stand a reasonable overload, say, 25 per cent., without injurious sparking.

5. Insulation.—This is a cause of frequent trouble and annoyance. The common practice is to specify an insulation resistance of so many megohms, regardless of the size of the machine and the voltage and conditions of service. Considering the

fact that this resistance varies inversely as the area of surface to be insulated, and considering the enormous variations in size, shape, voltage and service requirements of different machines, it is evident that such a test is impracticable and means little or nothing. Insulation resistance is largely a question of dryness, and if an armature be baked for a sufficient length of time, almost any resistance within reason can be obtained. I have known a large 400 kilowatt lighting armature to measure a

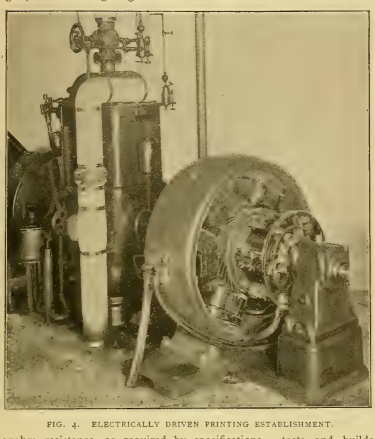


FIG. 4. ELECTRICALLY DRIVEN PRINTING ESTABLISHMENT.

megohm resistance, as required by specifications, after several days' baking (which, by the way, permanently injures the structural strength of the insulating material) and yet it showed practically no resistance when it reached its destination, because it had been in the rain and dampness for a week or more, and the large surface naturally afforded an excellent lodging place for moisture. A day's run in a weak field, with the armature short-circuited, quickly brought the insulation up again.

The only proper way to insure good insulation, with reference both to the material used and the method of construction employed, is by a high-potential test applied when the machine is reasonably dry. This test should be intelligently gauged by the voltage of the machine and the service required. Thus a high-potential test of 1,000 volts is ample to detect any insulation weakness in a 125-volt lighting generator, while a 5,000-volt test is ample for a 1,000-volt alternator, allowing proper factor of safety in each case. Recent careful investigations have developed the fact that the only correct way in which to determine the proper high-potential test for any given machine is to consider jointly the time duration of test, the current frequency and the voltage of machine. As the latter rises, the margin between it and the test voltage necessarily decreases on account of the liability to permanent injury of the insulation when subjected to excessive voltages. Because 5,000 volts is found to be a proper test voltage for a 1,000-volt machine, it by no means follows that 50,000 volts is proper for a 10,000-volt machine, or that the apparent factor of safety should be the same as the voltage rises. There should be a careful formulation of proper high-potential tests for different classes of apparatus, based upon scientific investigation and tests, and it is believed that it would not be a matter of any great difficulty to formulate such a schedule.

It is earnestly to be hoped that the Institute will consider that these questions come properly within its sphere of action, and that it will take action in a matter of so much moment to all concerned. It should be remembered that where special conditions are imposed which lead to deviation of design or to the manufacture of special apparatus, the purchaser, no less than the manufacturer, is bound to suffer, and it is the purchaser who pays the bills, directly or indirectly. If the purchaser finds himself involved in unexpected expenditures, the consulting engineer, too, comes in for his share of blame and dissatisfaction.

We come finally to the commercial requirements which have gradually found their way into specifications, and which are sometimes onerous and unfair. Perhaps the most important of these is the question of shipments. It is not uncommon for shipment to be specified by a certain date, under a forfeiture of so many dollars a day for each day's delay thereafter, and the award of the contract is often largely affected by such promises. The manufacturer starts the work in his shops, and if the time is short he is apt to work overtime. About the time the apparatus is ready for shipment, and without any previous warning, word comes to withhold shipment because the purchaser is not ready to receive it. There were recently 15 carloads of apparatus lying in the yards of one of our manufacturing establishments, besides a number of large machines stored in the shipping and testing departments, which had been made on time contracts and held at the last moment by request of the customer. It is difficult for one not in this end of the business to realize the resulting demoralization throughout the shops, and it is a condition which could easily be remedied by the exercise of more foresight on the part of the purchaser and his engineer. In all cases where a penalty for delay in shipment is imposed, it is fair and reasonable to ask that a similar bonus should be awarded if shipment is made in advance of promised date, or if the purchaser is unable, through no fault of the manufacturer, to receive the apparatus on that date. It is sometimes required that the consulting engineer shall have full access to the shops at all times while the apparatus is in production. Such permission is impracticable if proper shop administration and discipline are maintained, and these visits should be made at certain specified stages of the work. It is, of course, always proper for an engineer to be present when the apparatus is finally tested.

A clause is commonly found in specifications providing that the consulting engineer shall be sole judge of the true intent and meaning of the specifications; and in case of any dispute thereunder his decision shall be final and binding. It is true that this clause is common in architects and builders' contracts, but it is doubtful whether it could be enforced at law, in case of a dispute as to facts, and it certainly seems fair that in case of such a dispute, where the two parties honestly disagree, provision should be made for a third, disinterested party to act as arbiter.

While there are many contracts executed which involve one or more of the provisions (technical or commercial) mentioned above as liable to cause trouble, and where no trouble is experienced, due to the common sense and good judgment of both engineer and manufacturer, still the cases where trouble does arise are not infrequent, and the best

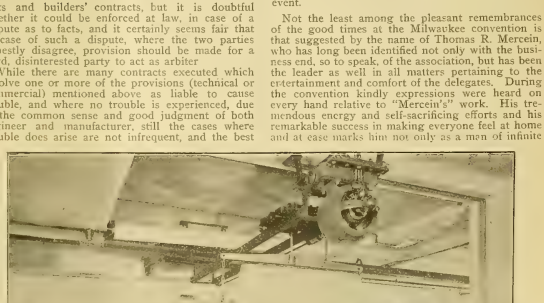


FIG. 3. ELECTRICALLY DRIVEN PRINTING ESTABLISHMENT.

specification is one so fair and so clear that no dispute or misunderstanding can arise, except with malicious intent, and which requires no arbiter to interpret its true intent and meaning.

In conclusion, let us hope that the customer, the consulting engineer and the manufacturer will, in the future, consult each other more freely and frankly, by personal interview or by correspondence; and that all of them will unite in indorsing any intelligent attempt to standardize such tests and technical requirements of electrical apparatus as are matters of common usage in our daily business intercourse.

DISCUSSION.

Lieut. Greene's paper was discussed by Max Osterberg, Gano S. Dunn, C. O. Mailloux, H. B. Coho, C. E. Emery and F. B. Crocker. The following resolution was duly presented and adopted:

"Resolved, That in view of the excellent suggestions and recommendations on standardizing apparatus embodied in Mr. S. D. Greene's paper, the society hereby expresses its approval of efforts in that direction, and invites the American Institute of Electrical Engineers to consider some comprehensive plan for such standardization of American apparatus for electric light and power."

Convention Echoes.

One of those who drifted into Milwaukee during the recent Northwestern Electrical association convention to have a glimpse of the boys was General Manager S. M. Hamill of the Brush company. Mr. Hamill now spends a large portion of his time in and about New York and Schenectady, and it was a pleasant surprise to see his face at a meeting so far west. He only remained a day, but even that short time was sufficient for him to have the opportunity of reviving a host of old acquaintances.

Meysenburg & Badt have already received many compliments upon the excellent showing they made at the Milwaukee meeting of the Northwestern Electrical association. Their display of Helios enclosed 200-hour arc lamps for 110 and 220 volts on direct-current circuits attracted considerable attention, and they have already received several inquiries. These lamps take five and three amperes at 110 volts and 2½ amperes at 220 volts. A 100-hour alternating enclosed arc lamp at 115 volts received its share of attention. It may be mentioned, too, that the exhibit of K. & W. specialties has stimulated trade in this line throughout the Northwest, especially in Hardy incandescent lamps, composite dynamo brushes, spark arresters, commutator compounds and open arc lamps. Mr. Badt says that his experience at Milwaukee was entirely satisfactory, as it enlarged his acquaintance among central-station men of that section and placed him in the way of doing considerable business. One sale of considerable importance was credited to the trip, and several deals that are still pending were further results of the event.

Not the least among the pleasant remembrances of the good times at the Milwaukee convention is that suggested by the name of Thomas R. Mercein, who has long been identified not only with the business end, so to speak, of the association, but has been the leader as well in all matters pertaining to the entertainment and comfort of the delegates. During the convention kindly expressions were heard on every hand relative to "Mercein's" work. His tremendous energy and self-sacrificing efforts and his remarkable success in making everyone feel at home and at ease marks him not only as a man of infinite tact but as a prince of entertainers. Mr. Mercein has several times essayed to resign the secretaryship, but has each time so ignominiously failed in his effort to escape that his many warm friends have persuaded him to give up trying and yield to the inevitable. It would be difficult to find a more accomplished toastmaster, and it is safe to say that the pleasant tones of the "silver-tongued" secretary are still ringing in the ears of many who visited the '98 meeting of the Northwestern Electrical association convention.

A. L. Severance of the Pfister Hotel acquitted himself most creditably during the recent North-

western Electrical association convention through his unceasing efforts to further the pleasures and comforts of the delegates, not only during the three-days period of the convention, but even before that time. When it was decided that the convention would again be held at the Pfister Hotel, and this decision, it must be stated, was secured practically through Mr. Severance's energetic efforts and strong personal following, his first step was to send to every possible convention visitor a token of the hotel's good-will and earnest desire to further the interests and comfort of all to be present. During the convention period Mr. Severance was constantly on hand, and particularly the night of the banquet, when he saw that the difficult task of seating people at tables holding large numbers was carried out without a hitch. Mr. Severance, as is well known, has been for years in the hotel business, and was formerly connected with the Cadallic Hotel, Detroit. His experience with the traveling electrical public proved valuable during the convention, and it is safe to say that under his management the Pfister Hotel has bright prospects. It may also be stated that during his management the hotel's patronage has wonderfully increased.

A meeting has been held of the committee of the Northwestern Electrical association having in charge the subject of holding a mid-summer convention of that association. The suggestion of naming a date for the summer meeting to immediately follow the date of the meeting of the National association at Chicago was discussed, and Joseph M. Hill of the committee was delegated to confer with Samuel Insull, president of the National Electric Light association, on the matter. In this connection it is interesting to note that at a meeting of representatives of electrical interests of St. Louis at the Planters' Hotel on January 24th, the following committee was selected to organize a club for the purpose of securing as large an attendance as possible to the conventions of the National Electric Light association and the Northwestern Electrical association, providing that the meeting of the Northwestern Electrical association should immediately follow the meeting of the National Electric Light association in Chicago: A. C. Garrison, representing the Columbia Incandescent Lamp company; E. H. Abadie, representing Wagner Electric Manufacturing company; John C. Murphy, representing Fort Wayne Electric corporation; Joseph Franklin, representing Commercial Electrical Supply company; W. R. Mason, representing Walker company; H. A. Wagner, representing Missouri Edison company; Frederick W. Schlosser, representing Laclede Gas Light company; H. M. Humphrey, representing Bryan & Humphrey, consulting engineers; H. F. Broughton, contractor; C. Pattison, representing Westinghouse Electric and Manufacturing company; Richard McCulloch, representing Citizens' Street Railroad company; George D. Rosenthal, representing General Electric company. The plan for the proposed convention of the Northwestern Electrical association, three days of which are to be on board steamer and two days at Duluth and Superior, was received with favor, and those at the meeting agreed that they would make every effort through their agents and in other ways to make it large and make an organization as possible for the benefit of both associations. A. C. Garrison was elected chairman of the committee, and J. L. Murphy, who is a member of the committee, has written to Mr. Hill that he hopes to get representative of the Missouri and Texas lighting and traction companies to attend the meeting of the Northwestern association.

The city fathers of Gainesville, Ill., have closed a contract with the electric light company for lighting the streets.

Brown Emergency Device.

From the early days of steam engineering it has been apparent that a very quick closing valve which could be controlled from a distance would prevent a large part of the accidents to which steam machinery is subject, and in modern practice, which demands the use of very high pressures and high speed in steam and electric power plants, such a valve becomes more and more a necessity.

In case of the bursting of a large steam pipe, either in stationary or marine practice, it is usually impossible to get at the boiler valve to shut off the steam, until the boilers have emptied themselves through the fractured pipe, which, of course, makes it impossible to render any assistance to those who may have been overcome by the escaping steam or prevent the damage usually attending such accidents.

Another very serious class of accidents which have become common of late is the bursting of flywheels of large engines, due to increase of speed, which may have been caused by some very slight disorder of the governing gear or other cause. These accidents are often as destructive to life and property as the bursting of boilers.

The valve herewith illustrated, with its attendant auxiliary means of control, is the invention of G. W. Brown, and consists of a simple disk screw valve to which has been added an emergency piston which operates entirely independent of the screw and in no way interferes with its action, and which can be controlled from a distance, by automatic or manual means, to cause it to close itself by steam pressure instantly.

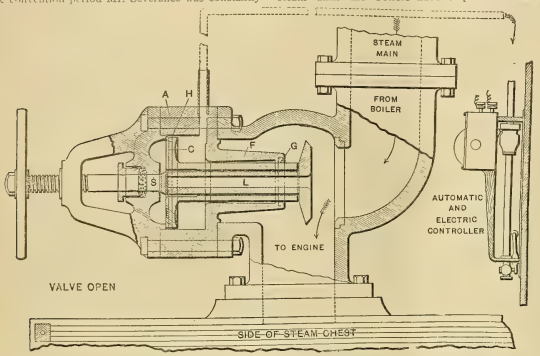


FIG. 1. BROWN EMERGENCY DEVICE.

On the common form of valve body is bolted or cleated a cylinder A; upon this cylinder is attached the usual bonnet or cover which carries the screw and hand-wheel (Fig. 1). In the cylinder is a piston, C, provided with a loose-fitting ring, H, around which steam is permitted to leak. The rod, F, also loosely fits a ring, G, and the screw plug S presses against the valve stem but is not fastened to it, covering or closing the passage L when the main valve is open, also when closed by the hand-wheel, as in Figs. 1 and 2.

When closing the valve by the hand-wheel, the spaces M and N being filled with steam, the valve simply acts as a screw valve, the pressure on the underside of the valve disk keeping the valve stem forced against the end of the screw, S.

To close the valve instantly, as in Fig 3, it is only necessary to open the vent, or relief pipe, E, by automatic or manual means, which takes the pressure off the under side of the piston, allowing the pressure on the top to force the valve to its seat. The piston having a much larger area than the valve, it has a large surplus of power to overcome any resistance or steam pressure against it.

As long as the screw remains out, the steam passing through the hollow stem L maintains boiler pressure on the top of the piston and holds the valve shut, but it can be opened instantly by closing the vent, or relief pipe, and turning the screw in to close the passage, L, then turning the screw back.

The vent, or relief pipe, is a small iron or brass pipe which may be extended to any part of the engine or boiler room, or outside of the same if desirable, and be provided with small screw or lever valves at convenient points, the opening of any one of which, by hand or other means, will cause the main valve to close by the emergency piston. The same principle is applied to the gate type of valve as well as to the globe and angle type, but through somewhat different methods.

To guard the engine automatically against running away and the consequent bursting of the flywheel, the relief pipe is extended to a controller which is provided with a small lever valve at the end of the relief-pipe connection, a tiny weight sliding upon the same and which in falling opens such relief valve, a small governor (driven by a small band connection with the engine shaft) controlling the weight. This governor is adjusted to drop the weight to open the relief valve and cause the throttle valve to close, when the overspeed of the engine reaches the predetermined danger point, and which when once adjusted to such speed requires no further attention. The bearings of the governor run on fiber graphite and require no oiling.

To give control of the engine from a distance and guard against accident to operatives and machinery in mills, factories, etc., the different floors or rooms are provided with electric push-buttons connected with an electric device operating through an electro-magnet in the controller. The pressing of any of these buttons operates the controller, causing the engine to stop, the same as in the automatic action. These push-buttons are of peculiar design, enclosed in small iron boxes and so arranged that they cannot be reached without ringing a small alarm bell, which prevents tampering by the inquisitive, and also furnishes a means of testing the electric circuit without closing the main valve.

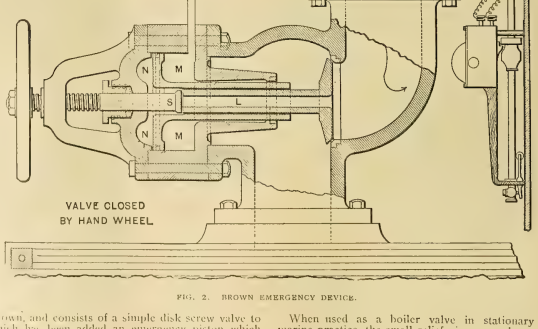


FIG. 2. BROWN EMERGENCY DEVICE.

When used as a boiler valve in stationary or marine practice, the small relief pipe runs along the steam main and enters it at some convenient point. Should the main steam pipe burst, the fall of pressure in the relief pipe would cause the valve or valves with which it is connected to close. It may also be operated electrically and manually from distant points of safety in a ship or building. When used as a throttle valve on marine engines it is further provided with an easy lever adjunct, which does not interfere with the screw or emergency action.

The Electro-steam Appliance company of 320 Broadway, New York, controls the manufacture and sale of this apparatus and owns the patents covering the invention.

Cartwright Enclosed Air-tight Fuse.

The Cartwright enclosed air-tight fuse is manufactured by the Shawmut Fuse Wire company of Boston under license from the Goodhart Electric company. In this device the fuse is so constructed that the wire melts within the central section of the tube, and the heated air and gases formed thereby, forcing themselves to the outer or end sections, blow out the arc. This fuse can be used on any pressure less than 2,200 volts. It will not maintain an arc between its terminals when short-circuited on the mains of a 2,200-volt composite alternating dynamo.

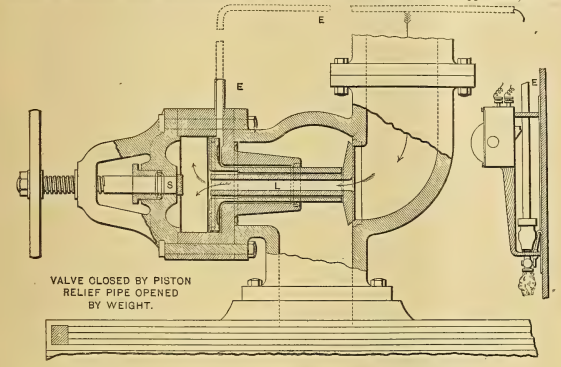


FIG. 3. BROWN EMERGENCY DEVICE.

The cut-out consists of two parts, the base and tube. The base is made of the best quality of Monson slate; the tube is made of black or gray fiber. Fig. 1 depicts the cut-out complete. Fig. 2 shows the fuse with the central part of the case cut away to show the fuse wire in the central air-space and also the filling at each end, while Fig. 3 represents a 50-ampere fuse cut open after it had been short-circuited on a 500-volt circuit of 450 kilowatts capacity and had opened the circuit without noise or flash.

Owing to the peculiar construction of this enclosed safety fuse, a tube or case three inches long will open the circuit, where other devices require more than twice that length, operated under the same conditions and with a fuse of the same carrying capacity. This fuse has a definite length, cannot come in contact with any foreign substance, and it will open the circuit in a predetermined time on a given current in amperes. Each fuse is marked with the number of amperes it will carry indefinitely; it will melt on a 25 per cent. increase of current.

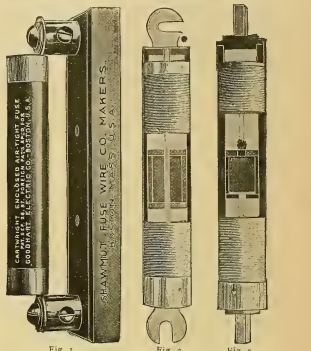


Fig. 1. Fig. 2. Fig. 3.

CARTWRIGHT ENCLOSED AIR-TIGHT FUSE.

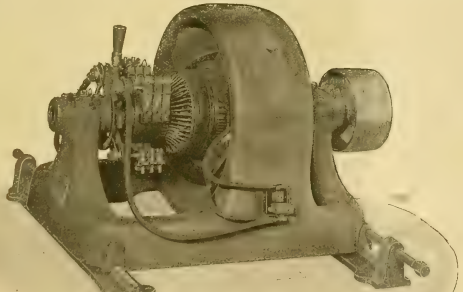
No More Steam Roads for Connecticut.

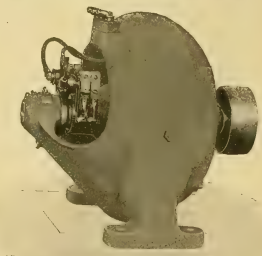
The annual report of the Connecticut railroad commissioners shows that there are 385 miles of electric railroad in the state, an increase of about 32 miles over last year. The 29 companies have $9,770,440 of stock issued. Their bonded debt is $7,092,800 and floating debt $1,071,421. They carried last year about 43,000 fewer passengers than they did in 1896. They paid in dividends $265,623, as compared with $221,119 in 1896. The commissioners say that no more steam roads are likely to be built in Connecticut.

New Dynamos for Moderate Speed.

The General Electric company announces a line of new and improved slow and moderate-speed belt-driven generators for both lighting and power purposes. The features of excellence in the older styles have all been retained, and while the new line is somewhat different in appearance, it embodies all the improvements suggested by experience with the older types.

These machines are of the four-pole type in the larger sizes. Fig. 1 illustrates the design. The construction allows of economical distribution of the magnetic material, while by shortening the magnetic circuits the exciting current is reduced and the efficiency increased. Reduction in speed implies increase of weight if the same output and efficiency are to be obtained, but low speeds with small weight per kilowatt are possible in these machines, owing to the economy in material effected by the adoption of the four-pole type. As the frames are of the highest quality of iron and the pole-pieces of special soft steel, these generators are lighter than even others of the same output but higher speed. The floor space occupied is small; the frame is strong, rigid and graceful, and the dimensions are as small as possible consistent with stability





FIGS. 1 AND 2. NEW DYNAMOS FOR MODERATE SPEED.

The pole-pieces are detachable from the frame, and thus the field coils are removable without disturbing the armature. The armature is built up of japanned sheet-iron laminations assembled on a cast-iron spider. Air ducts separate the laminations into groups and provide for thorough circulation through the windings, core and spider. The windings are copper wire coils, formed and insulated before assembling on the core. In some of the larger sizes copper-bar windings are used. By means of a projecting spider, the windings are bound down solidly and additional radiating surface provided. This method of construction insures perfectly insulated coils and renders failure of insulation, due to abrasion, practically impossible. The armature insulation is similar to that used on the General Electric railway motor armatures. It is tough, impervious to moisture, and, unless exposed to extraordinary overload, practically indestructible. It offers a high resistance to puncture, rendering injury by lightning impossible. The commutator is built up of special hard-drawn copper and mica of the finest quality. The brush-holder boxes which hold the carbon brushes are connected to the stud by a solid shank, insuring correct brush setting and firm and accurate contact with the commutator. A flexible conductor permanently attached to the brush forms perfect connection to the brush holder. Adjustments for pressure are made by a thumb nut and pressure spring. The pillow blocks are cast with the bed-plate, and the bearings are self-aligning and self-oiling.

These generators are sparkless, and the brushes, being of carbon, require no shifting in changing from no load to overload. The only wear on the commutator is that due to friction, and the use of carbon brushes reduces this to a minimum. The rise in temperature in any part of the machine, except the commutator, will not, it is claimed, exceed 45° Centigrade, after continuous full-load run of 10 hours, while the temperature rise of the commutator under the same conditions will not exceed 55° C.

The four-pole machines of the slow-speed type are built in capacities from 6.5 kilowatts to 75 kilowatts; of the moderate-speed type from nine kilowatts to 85 kilowatts. They are wound for 125, 250 and 500 volts. Many of them can be adapted for direct coupling to engines by mounting the machine on an extension of the engine bed, and connecting the armature to the engine shaft through a coupling.

The smaller sizes of the slow and moderate-speed generators now being built by the General Electric company are of the bipolar type, and, while embodying the same style of construction as the four-pole machines, differ greatly in appearance, as may be seen by reference to Fig. 2. They are known as L. B. (ironclad bipolar) machines, and, as will be noticed, have a field frame completely surrounding, and protecting from mechanical injury both field spools and armature. The small size of these generators, their compactness, and the small floor space occupied render them peculiarly suitable for small

isolated plants, and being adapted for direct driving, they make neat sets for small yacht and launch plants. The slow-speed I. B. generators range in capacity from three-fourths kilowatt to 4½ kilowatts; the moderate-speed from 1½ kilowatts to 7½ kilowatts. All are wound for 125, 250 and 500 volts.

Simple Measuring Instruments.

The cut shows the general appearance of a line of low-priced ammeters and voltmeters made by the Cherry Electric Works of 25 and 27 Third avenue, New York. Each instrument reads to 10 amperes or 10 volts. These instruments are so inexpensive that they may be thought toys, but the manufacturers declare that they are practical instruments, scientifically constructed, and useful, as far as available, to the experienced electrician as well as to the student and amateur. They are furnished in hardwood cases and are of attractive appearance.

Indiana Mutual Telephone Association.

The annual meeting of the Indiana Mutual Telephone association, which was held at the Bates House, Indianapolis, January 19th, confirmed the impression that the independent movement is gaining ground daily, and is making great strides, particularly in that state. The morning session was in the nature of an "experience meeting," when managers of different exchanges told of the progress they were making and how they met competition. E. H. Andress of Lafayette, president of the association, declared that the independent telephone business throughout the state was on the increase, both in the number of subscribers to older exchanges, and in the number of new exchanges which were being put in. He said that in the beginning the home companies were regarded by competitors as short-lived, but the independent organizations had now become an important factor, and were really outgrowing the Central Union company in strength. This showing indicated that home companies should continue in the thick of the fight. It was the experience of all that where a home company and the Central Union are at war the people were inclined to the home organization.

George W. Beers of the Home Telephone company of Fort Wayne reported that that company had 1,400 subscribers and charged a rental of $36 a year for telephones in business houses and $24 for those in residences. Where a subscriber had both, the rate was $48 a year for the two. He said that the company had 700 miles of wire reaching other towns in Indiana and Ohio. This brought up the question of establishing long-distance service between independent companies. It was stated that many home companies had their local exchanges connected with smaller towns nearby, and this kind of service was becoming more common every day, and it is now reaching the point where the association expects to connect all of the central stations, so that in time the whole state may be reached through the offices of home companies.

A committee was appointed a year ago to confer with similar committees of independent associations in Pennsylvania and Ohio. In its report it showed that the independent enterprises were carried on in these three states to a greater extent than in others, there being at present 250 independent exchanges, with more than 100,000 subscribers, and capital invested exceeding $5,000,000. The report said that the demand upon home companies is now for more extended long distance service. That this might be accomplished, it was stated that in the three states mentioned, Ohio, Pennsylvania and Indiana, organizations are forming. To further this work, committees from the three states had been appointed. That from Indiana consists of E. H. Andress, George W. Beers and Hugh Daugherty. The committees had conferred with the Western Union and Postal Telegraph companies, with the object of forming an alliance of some kind whereby the long-distance lines might be established. But the possibilities were so remote, the committee said, that about the only way to obtain the desired result was to incorporate the independent exchanges of the state into one company, with sufficient capital to build the connecting line. It was recommended in the committee's report that this movement be taken up at once and developed as rapidly as possible.

In the afternoon an executive session was held, and the following named officers were elected for the ensuing year: President, E. H. Andress of Lafayette; vice president, J. S. Stone of [illegible]; secretary and treasurer, A. E. Reynolds of Crawfordsville; assistant secretary, W. H. [illegible] of Bluffton; executive committee, E. H. Andress, J. S. Stone, A. E. Reynolds, George W. Beers of Fort Wayne, C. M. Zion of Lebanon, Elliott Shirt of Noblesville, A. E. [illegible] of Crawfordsville.

Southern Telephone Notes.

[Special [illegible] correspondence of the [illegible]]

The telephone [illegible] in Orlando, [illegible] some time ago [illegible]. There are 87 subscribers [illegible]. The system [illegible] a line to Winter Park, [illegible] miles distant, and the [illegible] which will, it is expected, in the near future be extended to Maitland, Altamonte and Sanford, the latter town being [illegible] miles from Orlando. The instruments of the Phoenix Interior Telephone company are used in this system.

J. A. Sutton has resigned as manager of the Bell telephone office at Winston, N. C., and his successor has not as yet been appointed.

A resolution has been introduced in the Norfolk (Va.) Council asking the members of the Legislature from Norfolk to support the bill permitting that city to regulate telephone tolls.

A telephone line will soon be built between Raleigh and Chapel Hill, N. C.

A charter has been granted to the Lexington (Va.) Telephone company, recently organized with a capital stock of $5,000.

The Rockbridge, Alum, Longdale and Lexington Telephone company has been granted a charter, with a capital stock of $5,000.

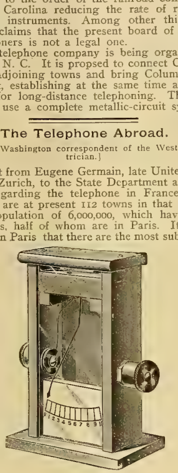
The Southern Bell Telephone company has filed objections to the order of the railroad commission in North Carolina reducing the rate of rental of telephone instruments. Among other things the company claims that the present board of railroad commissioners is not a legal one.

A new telephone company is being organized in Charlotte, N. C. It is propsed to connect Charlotte with the adjoining towns and bring Columbia into the circuit, establishing at the same time a rate of 15 cents for long-distance telephoning. The company will use a complete metallic-circuit system.

The Telephone Abroad.

[From the Washington correspondent of the Western Electrician.]

A report from Eugene Germain, late United States consul at Zurich, to the State Department at Washington, regarding the telephone in France, shows that there are at present 112 towns in that country, with a population of 6,000,000, which have 18,191 subscribers, half of whom are in Paris. It is not, however, in Paris that there are the most subscribers



SIMPLE MEASURING INSTRUMENTS.

in proportion to the number of inhabitants, for at Cannes the proportions is 1 to 120; 1 in 198 at Fourmies; 1 in 215 in Mentone, and 1 in 222 at Tourcoing, as against 1 in 253 in Paris. In France the telephone is little used in comparison with neighboring countries, like Germany and Switzerland, for while the number of communications in France last year was only 74,000,000, the total for Germany, excluding Bavaria and Wurtemburg, was over 424,000,000. Switzerland, with a population barely a tenth of that of France, had at the end of last year over 1,000 miles of telephone lines, with 29,533 subscribers and about 15,000,000 communications.

While the cost of the telephone in Switzerland is more than covered by the receipts, the conditions are different in France, although the subscription price is much higher than in the other countries, being $80 per annum in Paris, and from $40 to $60 in provincial towns, to say nothing of each subscriber having to contribute toward getting into the system. In Switzerland, in addition to the charge of getting an instrument put in and connected, the charge is $80 per annum, and five centimes (one cent) for each conversation of three minutes' duration. The government of Switzerland operates the telephone system.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

At the recent annual meeting of the Mutual Telephone company of Des Moines, Ia., there were reported in operation 950 instruments, and the plant represented an expenditure of $53,000. The receipts for the next year were estimated at $23,000 and the expenses $12,000.

The council of Bloomfield, Ia., has granted a franchise for a telephone exchange. It will have to be voted on by the people before it becomes effective.

The Wisconsin Telephone company is an applicant for a franchise at Marshfield, Wis.

The council of La Crosse, Wis., recently tested a police telephone system manufactured by the American Electric Telephone company. It consists of an automatic device, with an arrangement by which a red light can be shown at the box to notify the officer that he is wanted in case there is a telephone call to headquarters requesting an officer. This [illegible] great deal of time and increases the efficiency of the force. It is said if the city of La Crosse puts the system in it will be the first city in the country.

The council of Denison, Ia., recently granted the Iowa Telephone company a franchise in accordance with a vote of the people. But the mayor is dissatisfied with the rates proposed by the company and wants the council to pass on them. The mayor will explain the rates prevailing in other towns, and is prepared to make a strong case against the company.

The people of the town of Lincoln, near Alma, Wis., want telephone connection between Alma and Cream P. O. From there the farmers expect to build a line of their own up the valley.

The Northwestern Telephone Exchange company is preparing to connect the Grand Forks, N. D., exchange with the Crookston, Minn., system.

A. T. Presson will establish a telephone exchange in New Richmond, Wis., in the spring.

The Seattle, Wash., Telephone company's list has now reached 1,500 subscribers.

Telephone War in Iowa.

According to a dispatch from Des Moines, Iowa, January 26th, the Mutual Telephone company, which is the Bell Telephone company's rival there, claims that the big express companies will discontinue the Bell service. The war now being waged in Iowa is said to be the hardest ever experienced by the Bell company. A toll line with a metallic circuit will be built to Oskaloosa early in the spring, and will connect with the Mutual exchanges in Dubuque and other cities in the eastern part of the state.

American Street Railway Association.

[Special dispatch to the Western Electrician.]

Boston, January 25.—The executive committee of the American Street Railway association met here to-day. Considerable business of a routine character was transacted and the plans for the next meeting examined. The time and place of the annual convention of the association were fixed. Mechanics' Hall, Boston, was selected as the place and September 6th the date for the meeting.

CORRESPONDENCE.

New York Notes.

New York, January 25.—The contract for the electrical equipment of the Manhattan elevated railroad system doesn't seem to be getting signed with the glad precipitancy that one might suppose. The directors have taken no action in the matter, so far as known, and Major J. W. Hinkley, president of the Walker company, now claims that officials of his company have been misquoted when they have been made to say that contracts with the Manhattan company were as good as signed. This was not the fact, he said. No contracts had even been drawn up. Major Hinkley proceeded to explain that in such an important matter as the equipment of the elevated road with electricity much consideration was necessary, and that the directors of the road would be certain to go into every possible detail, a programme involving the consumption of much time and labor before they would be ready to take decisive steps. The Walker company was working on its plans and specifications, he said, but it would take some time to finish them before they could be presented to the directors of the Manhattan company; how long, Major Hinkley could not say. President Gould of the Manhattan company has written to the Rapid Transit Commission to state what extensions his company will build, if allowed to do so, but he does not say a word about electricity. In answer the commissioners ask for more information, but are as dumb as oysters about the electrical equipment. Some people profess to think that the Manhattan company is not sincere in its promises—and there you are.

The subject announced for the meeting of the Institute to-morrow night is a discussion of the "Standardizing of Generators, Motors and Transformers." It is proposed to discuss the question from the technical point of view, in its relations to the designer, the manufacturer, the consulting engineer and the user. Consideration will also be given to the policy on the part of the Institute in undertaking to bring about such a result.

February 10th is the date now set for the completion of all work connected with the trolley-car service on the Brooklyn bridge. The cars crossing the bridge will carry a sign on the dashboard reading: "Direct to New York."

Assemblyman Cain of Brooklyn has introduced in the Legislature the bill of last year providing for a commission to consist of the attorney-general, the controller and the state engineer to regulate telephone charges. The rate in New York city is to be $85 a year, and from this it runs down to $27 a year in places of less than 8,000 inhabitants.

At the annual meeting of the American Society of Civil Engineers, held in this city last week, the election of officers resulted as follows: President, Alphonse Fteley, New York; vice-presidents, Edward P. North, New York, and Frederic P. Stearns, Boston; treasurer, John Thompson, New York; directors, S. L. F. Deyo of New York, John Kennedy of Montreal, Henry Manley of Boston, John J. McVean of Grand Rapids, George Y. Wisner

of Detroit and Charles C. Schneider of Pencoyd, Pa.

Brooklyn's first experiment with an underground trolley railway will probably be on the little road running on Montague street, from Court street to Wall street ferry. This is at present operated by cable, but the Brooklyn Heights company, in whose system it is included, contemplates an early change to the underground trolley. The change will cost, it is said, about $100,000. M. S.

PERSONAL

Henry Charles Fischer is about to resign the controllership of the Central Telegraph Office, in London, which he has occupied ever since the telegraphs were taken over by the state. He is a German by birth, but has lived in London for 40 years.

Frank A. Rogers has resigned the position of general manager of the Card Electric company of Mansfield, O. Mr. Rogers was with the Brush company for a period of 14 years and afterward with the Short Electric Railway company. He has a wide acquaintance in the electrical trade.

Cyrus Robinson, formerly with the Ridgway (Pa.) Dynamo and Engine company, is now the engineer and vice-president of the Portland Manufacturing company of Portland, Oregon. This company intends to manufacture electrical equipment for mines —a branch with which Mr. Robinson is especially familiar.

W. R. Garton has severed his connection with the Central Electric company of Chicago and will soon open an office in this city. Mr. Garton, who was in charge of the railway department of the Central company for three years and a half, will hereafter devote his time to his personal interests as well as the representation of eastern manufacturers.

President Gibbs of the Marsden company, who was formerly president of the Electric Storage Battery company of Philadelphia, has been in Chicago several days to further the interests of the corporation he represents. He says the $1,000,000 required to equip new plants and provide working capital has been obtained. A trial of the Marsden cellulose as a packing for war vessels was recently made at Portsmouth, England, before government officials, and it is claimed that it proved a great success.

Mr. F. S. Terry has removed, with his family, to Newark, N. J., where he will take an important position with the Weston Electrical Instrument company. For 14 years Mr. Terry has been one of the leading figures among the electrical business men of Chicago. He has seen a remarkable expansion of this industry in this city and has been active in every concerted movement of electrical men. As president of the Electrical Supply company and later the Ansonia Electric company until 1893, and as manager of the Sunbeam Lamp company after that date, Mr. Terry became well known to members of the electrical fraternity all over the country. He was one of the organizers of the National Electric Light association, and for several years he was treasurer of the old Chicago Electric Club. His shrewd judgment and business experience have always been recognized by his associates and friends in the West, who, while wishing him success in his new undertaking, will still regret his departure from Chicago. However, Mr. Terry will still retain an interest in the Sunbeam company, so that his business ties with the western metropolis will not be entirely severed.

ELECTRIC LIGHTING.

A strong effort is being made to have Orlando, Florida, lighted by electricity, and it seems probable that within a short time such a plant for this purpose may be erected by private enterprise.

The contract for the wiring, tubing and switchboard for the United States postoffice building at Washington, D. C., has been awarded to the Southern Electric company of Baltimore, Md., at $20,650.

The superintendent of city lighting at Richmond, Va., advertised for bids for lighting the city electrically, but so far has not received any proposals, and the time has accordingly been extended to February 1st.

ELECTRIC RAILWAYS.

A London paper states that the work on the Jungfrau railway is being pushed forward in spite of the severe weather which prevails in Switzerland. In Lauterbrunnen water power to the extent of 2,400 horse power is now available, and half of this is being utilized for the motors employed in the boring of the Eiger shaft or tunnel.

It is stated that Judge Wheeler of the United States Circuit Court of New York has handed down a decision sustaining the validity of the electric railway motor-suspension patent controlled by the General Electric and Westinghouse companies and ordering an injunction against the Union Railway company of that city and the Walker company of Cleveland.

The Congressional bill looking to the extension of the Lexington and Soldiers' Home railroad and its amalgamation with the Belt Line railroad, and the purchase or lease of the Maryland and Washington railroad has been reported back to the Senate favorably. The bill for the extension of the lines of the Capital Traction company has been reported back with some slight amendments as to the route to be traversed in the line of extension.

It is reported in Appleton, Wis., that the Chicago and Northwestern Railway company has secured an option on the line of the Appleton Electric Street Railway company. A. L. Smith, president of the local railway company, is said to have admitted the truth of the report, but denies the further story that the Northwestern is planning to compete with the Inter-urban Electric company, which now has a line in the Fox River valley. The line will be 65 miles in length, if built, and will include the following-named cities as routes: Depere, Wrightstown, South Kaukauna, Appleton, Neenah, Menasha, Oshkosh, and Fond du Lac, besides many small manufacturing villages along the Fox River.

The war that has been waged by the Brunswick Traction company against the Philadelphia Traction company for the right of way through the towns of Somerville and Raritan resulted in a victory for the Philadelphia company, to which a franchise was granted January 24th by the Somerville town commissioners to build its road through the town. The road will cut out the Brunswick company, which has already built seven miles of its proposed route connecting the towns of Raritan and Somerville with New Brunswick. The company is required to deposit $17,000 as a guarantee fund. The company will pay a yearly rental to the town for 10 years averaging $250 per year, after which the town will receive three per cent. of the gross receipts of the company.

Earnings of the National Railway company of St. Louis for the year 1897 were 8.45 per cent. applicable to the 6 per cent. bonds of the company. These earnings stand against 9.22 in 1896, 8.05 in 1895, 8.85 in 1894, and 9.08 in 1893. The annual meeting of the company was held in Chicago on January 25th. While the properties are located in St. Louis, the controlling interest in the stock is in Chicago. The election of directors resulted in the choice of W. T. Baker, E. Buckingham, T. J. Lefens, G. T. Smith, D. G. Hamilton, E. G. Foreman and C. L. Raymond. The past business of the company was altogether satisfactory to the shareholders. The company pays six per cent. dividends. The business of the year ran about as with other street railroad corporations, that is, the last four months were good and the first eight relatively poor. The current operating expenses were 59.9 per cent. of the gross receipts—61.6 per cent. for the cable lines and 59.1 for the electric lines. The total car-miles run was 12,010,683, and the total passengers carried, 29,350,513. The total cost of carrying each passenger was .5 cents. By cable, 4.22 cents; by electricity, 4.27 cents. The gross receipts were $1,467,975.78.

ELECTRICAL SECURITIES.

Columbia Construction company stockholders are to be given the privilege of subscribing for the $4,000,000 Chicago Northwestern "L" bonds it was recently decided to issue.

The New Orleans Traction company reports gross earnings for December of $107,026, a decrease of $1,995 as compared with the same month of the previous year, and net $45,399, an increase of $8,457. For the year ended December 31st the gross earnings were $1,237,250, a decrease of $85,756 as compared with the corresponding period of the previous year, and net $399,869, decrease of $184,284.

MISCELLANEOUS.

The State Department has been informed that the project of establishing an electric lighting plant in Belize, British Honduras, has been disapproved by the secretary for the colonies in London.

The contract for the motive power for the electric light and power plant of the United States postoffice building at Washington, D. C., has been awarded to the McKay-Howard Engineering company of Baltimore, Md., at $17,585. The contract calls for four Buckeye tandem compound engines and four Three-Bay dynamos.

The January meeting of the Engineering Association of the South was held on January 13th at the residence of Mr. Hunter McDonald in Nashville, Tenn. President Walker occupied the chair, and several new members were elected. Dr. William L. Dudley of Vanderbilt University delivered an address on "Improved Methods of Coke Making."

TRADE NEWS.

The Western Electric company has placed in stock a large supply of Victor split insulators. This insulator makes an effectual break insulator for overhead line wires and for guy wires.

There seems to be no limit to the reduction in the price of automatic rheostats. A few years ago an automatic rheostat for a one horse power motor was considered cheap at $25. Last year the price was reduced to $5, and now comes a reduction to $4.50 by a leading manufacturer of rheostats. It may well be doubted whether there is a reasonable manufacturing profit in making such an article at such a price.

Charles Martin of Detroit claims to have built the largest independent-telephone switchboard in the world. Mr. Martin, who has succeeded to the business of W. R. Cole of 14 and 16 Macomb street, Detroit, is prepared to furnish complete equipments for independent exchanges.

Lieut. E. J. Spencer, the western agent of the Safety Insulated Wire and Cable company, has just closed a contract by which his company supplies all the electrical conductors—inside and outside wire and underground cable—for the Trans-Mississippi and International Exposition at Omaha. Lieut. Spencer's office is at 24 Laclede building, St. Louis.

Under date of January 17th the New York Tribune printed this dispatch from Schenectady: "The General Electric company is preparing plans for one of the largest iron foundries ever constructed in this country, to be built in this city. It will be 500 feet long and 130 feet wide. The officials of the company also announce that they are considering the advisability of removing the branch lamp works at Harrison, N. J., to this city. The Harrison works new employ about 1,200 hands, but if removed to this city the works will be enlarged and the force increased to 1,800."

The Ames Iron Works of Oswego, N. Y., announce that they have opened a Chicago office, at 1452 Monadnock building, in charge of Mr. George K. Orrell. About two years ago this concern gave up its Chicago office, and in fact quite a number of its distributing offices in the West, on account of the fact that business conditions did not warrant keeping them open. But because of the decided improvement in business, and the large amount of inquiries for the company's product, it has decided to open this office again at once. The Ames automatic and throttle engines need no introduction, their points of excellence are thoroughly understood by the electrical trade. The Ames Iron Works also manufacture upright and horizontal boilers of any size.

Engine users will undoubtedly be pleased as well as interested by the news that the Armington & Sims company of Providence, R. I., has purchased the entire plant of the old Armington & Sims Engine company, and will continue the manufacture of this celebrated and standard make of steam engines. The officers of the new corporation are: President, Julius Palmer; secretary and treasurer, James C. Church; general manager, Fred N. Bushnell. The board of directors is one of the strongest, financially, that is identified with the business in Providence. The company is capitalized for $150,000, paid in full. Julius Palmer, its president, is one of the leading business men of Providence, being the president of the Old National Bank of that city. Fred N. Bushnell, the general manager, is peculiarly well fitted for this position. He has a technical education in mechanics, together with the practical experience of passing from tending a lathe in the shop to superintendent of large manufacturing installations. He has also acted in the capacity of advising engineer.

In announcing two lines of transformers in its January bulletin, the Wagner Electric Manufacturing company of St. Louis makes this interesting statement: "The manufacturers of transformers has two distinct classes of central stations to supply—those furnishing an all-day service and those furnishing only a night service. The former requires an equipment of transformers with a high all-day efficiency, while the latter can operate quite satisfactorily with transformers somewhat lower in efficiency. To meet the demands of both classes, this company will hereafter build two distinct lines of transformers in all sizes up and including the 150 lighter—the type G, extra high efficiency, and the type F, slightly lower in efficiency. The type G, which is fully described in our bulletin No. 9, is designed to afford a degree of economy in transformer service in excess of that hereto possible with transformers built by this or any other company. It furthermore embodies many decided mechanical improvements over all other transformers in the market. In bringing out this line it was our desire to produce something far superior to anything our competitors had to offer, or would be likely to have for some years to come, and the results achieved up to the present time indicate that our full expectations have been realized. We appreciate, however, that not every transformer buyer can install the high efficiency line, nor do we recommend this line for night-service stations, and to provide an improved type for his trade the type F has been brought out. This type will at once supersede the type D, which has been our standard for several years past. The type F corresponds in all electrical considerations to the type D, differing from the type D only in that it embodies all the mechanical improvements of the type G."

BUSINESS.

The Upton midget long-burning arc lamp is already a very popular specialty. The small size, light weight and tasteful appearance of the lamp make it a very desirable arc lamp for inside work, while its positive and steady action and general reliability make it a popular lamp for all places where a low

burning arc lamp is required. The Electric Appliance company, Chicago, will be glad to send its latest circular on this specialty on application.

The Deane pumping machinery is so well known that every engineer or power-station manager should have the company's catalogue. The latest issue and the supplements may be had by addressing the Deane Steam Pump company of Holyoke, Mass.

The Electric Storage Battery company of Philadelphia has issued a new catalogue which sets forth the advantages of employing accumulators, illustrating several prominent plants, and gives complete tables of the dimensions, capacity, weight, cost, etc., of each type of element.

The Eddy Electric Manufacturing company of Windsor, Conn., has been enjoying a prosperous season of late, having been obliged to run its large manufacturing plant 16 hours per day for a long time, in order to keep abreast of the orders which have been pouring in upon it. The Eddy motor and dynamo was one of the first manufactured, and the type is very well known. General Manager M. E. Baird is at present on the Pacific coast, where he has important business.

The Jewell Belting company of Hartford, Conn., has been selling some very large belts of late to central stations and isolated power plants. It reports that the outlook for business has not been as good for a long time as it is at present. Secretary C. E. Newton has been for some time at Knoxville, Tenn., where the large tannery interests of this concern are located. Mr. Newton is arranging for large additions to the tannery, in order to meet the increase in trade which has been apparent in their business of late.

The Western Electric company's 12-inch desk fan for 1898 is said to require less current to operate it than is used by a 16 candle power incandescent lamp. This economy over fan motors of the past three or four years shows a great improvement in mechanical detail as well as electrical design. The Western Electric company will soon issue a 32-page fan-motor catalogue, listing direct and alternating-current fan motors, also battery fan motors; and those interested in fan motors will do well to write for a copy of this pamphlet.

The Monarch Manufacturing company of Waterbury, Conn., finds that the call for its engine stop and split-loom device has become so great that it is considering the advisability of locating an office at Chicago to handle its trade for that section of the country. The device has particular advantages for use in electric light and power stations. The testimonials whic hthe concern shows in regard to this apparatus are numerous and from some of the leading manufacturers of the country. The company's new catalogue has been issued, and gives a very good description of this product.

The Hart & Hegeman Manufacturing company of Hartford, Conn., reports that the call for the Hart flush switches has been so large of late that it has compelled it to add materially to its force, in order to keep up with orders. The Hart switch has a porcelain base that surrounds all mechanism and contacts. The metal ears are provided for attachment to the wall or box, and it has the great advantage that all connections are made in front, thus avoiding the necessity of leaving slack wire behind the switch. It is adapted to fit narrow recesses, and will fit boxes usually provided for push patent switches.

The Pelton Water Wheel company reports a large run of business for the last two months of 1897. Among the more important shipments may be mentioned the following: Wheels, governors and accessories covering a 2,000 horse power plant for the Rafael paper mills, Mexico; six wheels for various other locations in Mexico; a 1,200 horse power wheel, with governors and accessories, for an electric transmission plant for Petropolis, Brazil, this being a duplicate of the former plant; an electric power transmission plant for Frujillo, Brazil; seven wheels with governors, pipe lines and accessories, to operate tea and coffee plantations in Java; three wheels for the Ruby mines in India; two 500 horse power wheels for operating mills in Tasmania, Australia; three 1,000 horse power wheels, with governors and accessories, direct-connected to Stanley generators, for the Yuba Power company, Marysville, Cal.; one 200 horse power wheel for operating the mill of the Dexter Gold Mining company, Tuscarora, Nevada; nine wheels for various mining operations in California. A large number of orders is in hand, making the outlook for the present year very encouraging.

ILLUSTRATED ELECTRICAL PATENT RECORD.

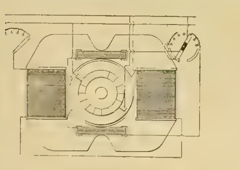
Issued January 18, 1898.

597,418. Regulation of Dynamo-electric Machinery. Frederic A. Johnson, Binghamton, N. Y. Application filed April 14, 1897.

The method of producing and varying the magnetic flux in a dynamo-electric machine consists in creating a magnetomotive force in a magnetic circuit composed at one or more points of several branches, generating, in one or more of the branches, a second magnetomotive force, and varying the second magnetomotive force at will to vary the total flux through the machine, while maintaining a strong flux through those branches of the magnetic circuit which furnish the field for the coils under commutation.

597,419. Regulation of Dynamo-electric Machinery. Frederic A. Johnson, Binghamton, N. Y. Application filed April 24, 1897.

A polar face excited from two separate necks, coils on the necks for furnishing the excitation, and switches for separately varying the currents in the coils.



NO. 597,418.

597,424. Electric Arc Lamp. Adolphe Mougin, Paris, France. Application filed February 13, 1897. Patented in France February 11, 1895; in Germany February 28, 1895; in Belgium August 7, 1895, and in England August 23, 1895.

Means are provided for obtaining the automatic formation of a short-circuit, whereby the motor for feeding the carbons, which is situated in the circuit of derivation, is instantly stopped when the carbons are used up, the same comprising a rod and spring insulated from the lamp and connected with the brushes of the motor, the rod upon being raised by the lower carbon-holder, as soon as the latter reaches the limit of its upward movement, coming in contact with the spring and causing the current, instead of passing through the motor to reach the lamp, to pass through the circuit of smaller resistance closed by the contact of the rod with the spring.

597,432. Electric Car Brake. Constant F. de Redon, New York, N. Y. Application filed September 22, 1896.

The magnet carried by the car and at each side of the latter is combined with a pivoted brake arm carried from the end of each magnet and turning inward in line with the length of the magnet, and a brake shoe for contact with the rail carried by each of the brake arm.

597,433. Electro-magnetic Railway Car Brake. Constant F. de Redon, New York, N. Y. Application filed April 22, 1897.

There is the electro-magnet at each side of the car, the pole piece extending from one end thereof and the brake arm pivotally secured to the pole piece, combined with the brake shoe carried by the brake arm and the pole piece extending from the other end of the magnet toward the brake arm.

597,467. Trolley Car [illegible] Hall, New York, N. [illegible] Application [illegible] February 1, 1897.

The attachment [illegible] provided with a circular head [illegible] to either end of the car, a shaft [illegible] through the head, a revoluble disk mounted [illegible] to the head, a spool mounted on the shaft [illegible] springs mounted at each side of the disk, one end of one of the springs being secured to the spool and the other to the disk, and one end of the other spring being secured to the disk and the other to the head [illegible] devices for locking the disks to the head so as to prevent the revolution thereof, and devices connected with the spool for releasing the locking devices and operatively engaging the disk, and the disk and the spool being adapted to revolve in the same direction.

597,472. Electro-mechanical Switch-operating Mechanism. Charles W. Squires, Springfield, Mass. Application filed April 9, 1897.

A device is employed for throwing the tongue, a car-wheel operated lever, a shiftable pawl to have a thrust imparted thereto by the lever and to shift the switch-throwing device, an electro-magnet and its armature engaged with the pawl, a catch device for automatically engaging the lever when depressed, and a part through which the catch is engaged with the armature.

597,476. Electric Furnace. Thomas L. Willson, New York, N. Y. Application filed November 15, 1895.

The furnace chamber has a hearth, an upright movable carbon pencil, an upright chamber adapted to wholly inclose the pencil in its movements, and a feeding flue discharging into the lower part of the upright chamber at one side thereof, whereby material dumped through the flue falls into the furnace chamber against the side of the carbon pencil, and an outlet flue leading from the furnace.

597,516. Electric Trolley Device. Gustaf Valley, Johnstown, Pa. Application filed March 8, 1897.

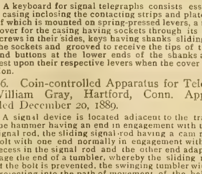
A trolley comprising a suitable base portion and a tilting standard pivoted thereto and upheld by yielding members is arranged with a pair of arms pivoted to the standard, a second pair of arms pivoted to the base portion, a contact-carrying arm pivoted to the upper ends of both of the pairs of arms, and compression springs secured between the pairs of arms and adapted to impart upward pressure to the contact-carrying arm.

597,536. Signal Telegraph. Claudius V. Boughton, Buffalo, N. Y. Application filed December 19, 1895.

A keyboard for signal telegraphs consists essentially of a casing inclosing the contacting strips and plates, one set of which is mounted on spring-pressed levers, a removable cover for the casing having sockets through its body with screws in their sides, keys having shanks sliding through the sockets and grooved to receive the tips of the screws, and buttons at the lower ends of the shanks adapted to rest upon their respective levers when the cover is in position.

597,556. Coin-controlled Apparatus for Telephones. William Gray, Hartford, Conn. Application filed December 20, 1889.

A signal device is located adjacent to the transmitter, the hammer having an end in engagement with the sliding signal rod, the sliding signal-rod having a cam recess, the bolt with one end normally in engagement with the cam recess in the signal rod and the other end adapted to engage the end of a tumbler, whereby the sliding movement of the bolt is prevented, the swinging tumbler with one end projecting into the path of movement of the bolt and the other projecting into a coin-channel, and the coin-channel carrier governor mounted in the frame, a brake-lever fulcrumed to the support and actuated by a spring to bear on the governor, and a link connecting the free portion of the frame and the lever to release the latter to the action of the spring.



NO. 597,432.

597,587. Telegraphic Signal. James Nicolson, Buenos Ayres, Argentina. Application filed February 26, 1897.

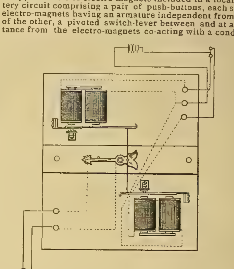
Telegraph signals having an uneven number of elementary motions for the vowels and accented vowels of the alphabet, and an even number of such motions for the consonants of the alphabet.

597,601. Electric Arc Lamp. Emanuel Blaser, California, Mo. Application filed July 15, 1897.

An improved arc lamp, including a support, a frame pivoted to swing vertically therein, a carbon carrier and a

597,642. Electric Switch. Everett M. French, Stoughton, Mass. Application filed September 16, 1897.

Claim is made for the combination with a suitable base of opposite sets of electro-magnets included in a local battery circuit comprising a pair of push-buttons, each set of electro-magnets having an armature independent from that of the other, a pivoted switch-lever between and at a distance from the electro-magnets co-acting with a conducting contact, and a main-line circuit including illuminating devices connected to the pivoted switch-lever and the conducting contact, and a cord extending in opposite directions from the end of the switch-lever farthest from the conducting contact and attached to the free ends of the opposite armatures, whereby the illuminating devices in the main-line circuit may be controlled by the push-buttons in the local battery circuit for illuminating and extinguishing purposes without carrying the heavy main-line wires into a building.



NO. 597,642.

597,650. Electric Lock and System of Electric Locking for Securing Additional Safety in Railroad Signaling. James F. W. Morris and George Mumford, London, England. Application filed October 16, 1896.

In a signal-receiving instrument for use on railways, the combination of a locking bolt for the handle of the instrument, a catch for the bolt, an electro-magnet excited by a current from an adjacent station for releasing the catch, and a gravity latch for supporting the catch when so released.

597,680. Keyboard Telegraphic Transmitter. Samuel Price, Paterson, N. J. Application filed June 17, 1897.

A keyboard transmitter is provided with means for transmitting electrical impulses in the nature of a Morse code over a telegraph line, in combination with propelling mechanism adapted to enable the operator to store up the prepared record in advance of its transmission and at any desired speed, together with additional propelling mechanism for causing the transmitted impulses to be sent at a substantially constant speed.

597,693. Trolley Wheel. Harry B. Sawyer, Chicago, Ill. Application filed June 19, 1897.

The removable bracket for trolley poles described consists of arms secured to the socket, in combination with a sleeve designed to be attached to the trolley pole and having upon its upper end an annular collar, and having secured near its lower end an adjustable collar in combination with a withdrawable spring-controlled stop-pin.

Western Electrician.
EVERY SATURDAY.
Vol. XXII. CHICAGO, FEBRUARY 5, 1898. No. 6

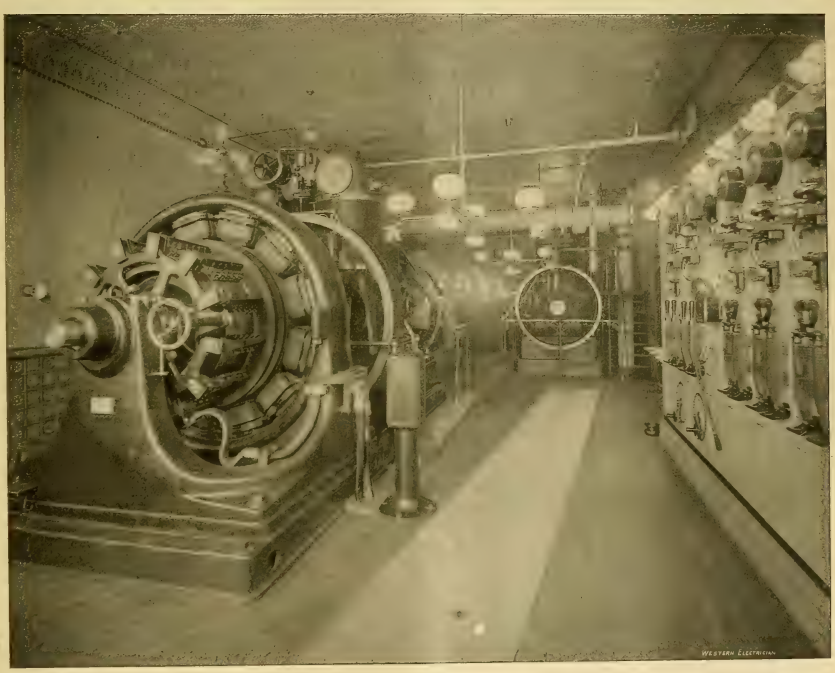
Modern Direct-connected Isolated Plant.

It is only when one compares the compact direct-connected isolated plants of the present day with the installations that preceded them and were operated under similar conditions that one fully appreciates the advancement that has been made in this class of work as well as in central-station practice. It is a noticeable fact that more attention is given to details nowadays, and that while economy may be practiced in the allotment of space for a generating plant, the arrangement and surroundings of the machines are much more favorable for efficiency in operation than formerly. An example that emphasizes these points is presented in the isolated plant of the Western Wheel Works of Chicago, which forms the subject of illustration on this page. This institution is one of the largest and most successful bicycle manufacturers in the country, and for the successful operation of these works modern methods and machinery are required. The present electrical plant has only recently been installed, but it has already demonstrated the wisdom of the management in the selection. It replaced an equipment that did excellent service for years, and which at the time was considered a fair example of the state of the art. The demand for larger capacity and modern design made the present plant necessary.

The original installation comprised two standard Mather dynamos driven by an Atlas engine belted to counter-shafting. This plant was illustrated in the Western Electrician, May 28, 1892, and reference to that issue indicates plainly the marked changes that have been made in this field. In place of separate dynamos and engines with counter-shafting and belting which was the accepted practice seven years ago, there are now direct-connected units occupying much less space and giving far higher efficiency.

As indicated in the picture on this page, the plant comprises two units. Westinghouse 125-volt generators of 275 kilowatts capacity, operated at 250 revolutions per minute, and Westinghouse compound engines with cylinders 18 and 30 inches in diameter and 16 inch stroke of piston are direct-connected by means of flexible spring coupling, forming the well-known Westinghouse Kodak type of connection. While the engines are designed for less than 400 horse power each, they have delivered as high as 500 horse power for weeks at a time without injury and with perfect success. The floor space occupied by each complete outfit is only 19 feet six inches long by seven feet 10 inches wide. The generators are compound wound for three per cent loss. The current is carried to the handsomely equipped switchboard of Italian marble shown in the cut, which contains two generator panels of 2,200-ampere capacity and five feeder panels of 1,500-ampere capacity. The current is distributed through the works and is used for lighting and operating motors. There are 3,000 lights connected up at the present time and 21 motors, including one 80 horse power, two 65, one 50, one 40, two 35, three 30, two 25, three 20, four 10 and two 5. The machines which formerly supplied current for light and power to the entire factory are now utilized as motors for driving shafting and form a comparatively small part of the present equipment.

The apparatus for the new plant and the engineering and construction work in connection with the equipment were furnished by the Chicago offices of the Westinghouse Electric and Manufacturing company and Westinghouse, Church, Kerr & Co. George D. Van Tassel, the engineer for the Western Wheel works, who has been in charge of the electrical plant since it was first installed, is very well pleased with the present equipment.



MODERN DIRECT-CONNECTED ISOLATED PLANT

Commissioner of Patents.

Charles H. Duell of Syracuse, the newly-appointed commissioner of patents, is vice-president of the Peckham Truck company of New York. Mr. Hatch of that company is quoted by the New York Tribune as speaking of his friend in these terms: "I have known Mr. Duell for 30 years, but almost wholly in a business way. He is a son of R. Holland Duell, who was a very prominent man in his day. R. Holland Duell was a member of Congress for three terms and was appointed commissioner of patents in September, 1875, and served as such until December, 1876, when he resigned. You can see readily from where Charles H. Duell derived his tendency toward the patent side of law. After his graduation from Hamilton College he came to this city and entered a law office. After being admitted to the bar he had an office for a number of years at No. 229 Broadway, but at length his inclination, as he had married a Syracuse woman, and the feeling that he could do better in a section of the state where he possessed greater family influence, led him to remove to Syracuse, where he has since remained. I regard him as easily at the head of the patent lawyers of the western part of the state, and one of the very best in the country. He entered into partnership with us about eight years ago on the patent side of our business. Mr. Duell has been married some 20 years and has children."

Efficiency Tests on the Englewood and Chicago Electric Storage-battery Road.

Since June 20, 1897, Chicago's storage-battery road has been attracting widespread attention by its successful operation. During the summer over 20 motor cars were operated, often with trailers, and thousands of people were carried each day between Sixty-third street and the cemeteries at Morgan Park, as well as to Blue Island. When the winter schedule of nine cars was instituted, it was decided by Mr. G. Herbert Condict, then general manager, to make a complete test of the road and of its model power house, to determine the most economical methods of operation. Three tests of the power house were conducted under actual operating conditions, no effort being made to obtain results better than might be expected in everyday service. As there has been no small amount of inquiry in regard to the cost of operating a storage-battery system, Mr. Condict has been prevailed upon to make the figures public, and the following abstract has been made of the very complete report of the work.

The tests were put in charge of Mr. George A. Damon, who was ably assisted by Prof. T. P. Sayler and a corps of students from the Armour Institute of Technology.

The details of the equipment of this road have been described completely in the Western Electrician of August 7, 1897, and the Engineering News of January 6, 1898.

I. Power-house Tests.

The boiler plant consists of three Heine water-tube boilers rated at 200 boiler horse power each, fitted with Roney mechanical stokers. The engines are triple expansion, condensing, of the Willans central-valve type, and were made by the M. C. Bullock Manufacturing company of Chicago. The plant at present contains two of these engines. Each engine has two lines of tandem cylinders, and is rated at 200 horse power at a speed of 380 revolutions per minute.

The engines are directly connected by means of the "Arnold system" to four six-pole, shunt-wound Walker power generators, rated at 190 kilowatts each when running at 380 turns per minute. In the system used to connect the generators each dynamo armature is carried on a hollow quill, through which extends a solid shaft with suitable mechanical connections so arranged at present that either engine can operate any number of the four generators at will. The generators are designed to deliver their rated output at a voltage varying between 160 and 190 volts.

Each engine exhausts into a jet condenser, made by the Worthington company, from which the condensed steam and heated injection water is raised by means of the air pump about 35 feet to the top of a Worthington cooling tower, in the bottom of which it collects ready to be again used in the condenser. The blast of air which evaporates a small part of the water, and the cool that remaining in the tower, is furnished by a fan operated by a Siemens & Halske motor taking current from behind the switchboard. The water lost by evaporation and otherwise in the system is replaced from either of two sources; the city mains or an artesian well, the latter fitted with a direct-plunger type pump.

The boiler-feed pumps are of the duplex compound type, made by the Worthington company, and ordinarily take their supply from the well of the cooling tower, pumping it through a closed feed-water heater in the exhaust line of the pumps and thence through the economizer to a common feed-water header above the boilers.

The hot flue gases from the boilers pass from the uptakes into a brick smoke flue extending the entire length of the boiler room. In a brickwork extension of this flue, located between the power house proper and the stack, is installed a Green economizer with passages and dampers so arranged that the economizer pipes may be made to intercept the hot flue gases. The economizer consists of eight rows of 24 pipes each, making a total of 192 pipes.

The stack is self-supporting and is constructed of steel. It is 150 feet high and seven feet in diameter.

Lack of space will not permit giving a complete description of the scheme of the tests nor of the precautions adopted by Mr. Damon to secure accurate observations on the coal and water consumed, as well as the output of the engines and generators.

All scales, steam gauges, thermometers, indicator springs, electrical and other instruments used were either the standard apparatus of the Armour Institute or were carefully calibrated.

The first test was with the plant running with two boilers, two engines and three generators. The second test was with practically the same load carried by one boiler, one engine and two generators, while the last test was made under practically the same conditions as the second test, with the exception that the three-voltage method of charging the batteries was abandoned. In this test but one generator was used and the batteries were charged in successive sets, all at a common potential, the voltage being raised as the batteries became charged in such a way that the load upon the generator was kept nearly constant.

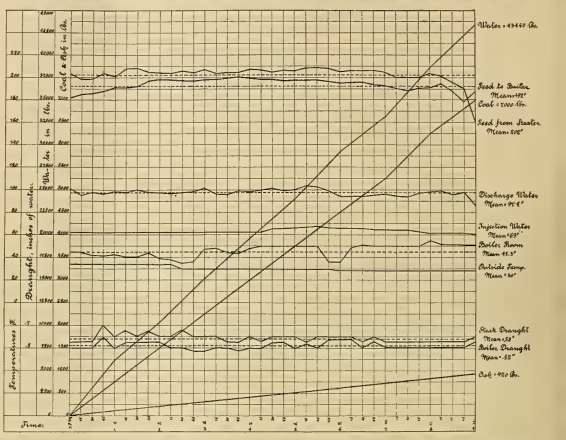


FIG. 1. EFFICIENCY TESTS OF THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE-BATTERY ROAD.—GRAPHICAL LOG OF BOILER TEST, NOVEMBER 26, 1897.

The coal used was from Fairmount, W. Va., and cost, delivered at the power house, $1.90 per ton. An average of five determinations of its calorific value by the Berthier method gave 10,145 British thermal units per pound. The average of six analyses gives the following result:

Moisture	6.326	per cent.
Volatiles and combustibles	32.903	"
Fixed carbon	48.126	"
Sulphur	2.700	"
Ash	10.030	"

Eight indicators were necessary to obtain the horse power developed by each engine. A typical record of one set of cards is shown by the following table:

Card No. 7—Taken 3:15 p. m. on November 26, 1897.

		M. E. P.	Horse Power.
High-pressure cylinder,	North Line	59.85	31.14
do.	South Line	71.2	37.16
Intermediate receiver,	North Line	15.6	6.96
do.	South Line	15.8	7.01
Intermediate cylinder,	North Line	21.8	28.19
do.	South Line	26.7	30.55
Low-pressure receiver,	North Line	5.85	6.25
do.	South Line	5.73	6.25
Low-pressure cylinder,	North Line	8.18	21.90
do.	South Line	8.81	26.81
Transfer chamber,	North Line	4.92	14 88
do.	South Line	5.12	16.46
Horse power,	North Line	112.45	
do.	South Line		120.27
Total horse power		232.72	
Revolutions per minute		373.3	
Gauge pressure		182.0	
Vacuum		26.5	
Kilowatt output		139.4	
Electrical horse power		186.9	
Efficiency		80 %	

Cards were taken every half hour during each test. The results of the cards taken during the test of November 26th are shown in the following table:

Time.	Card.	I. H. P.	B. H. P.	Efficiency per cent.
After test.	1	25.08	.....	Friction
After test.	2	32.36	.....	Friction
After test.	3	32.36	.....	Friction
3:15 p. m.	7	232.72	186.9	79.96
3:45	8	226.58	177.4	78.29
4:45	9	214.25	168.4	78.6
5:15	10	217.5	171.4	78.85
5:45	11	218.6	172.2	78.77
6:15	12	222.12	176.9	79.64
6:45	13	209.83	164.4	78.35
7:15	14	215.50	176.4	81.83
7:45	15	224.66	182.1	81.05
8:15	16	227.49	180.3	79.25
8:45	17	208.04	162.5	77.88
9:15	18	202.15	156.8	77.56
11:15	21	246.24	196.5	79.8
11:45	22	237.88	193.3	80.

Average indicated horse power, 217.
Average electrical horse power, 172.
Average all-day efficiency, 79.3 per cent.

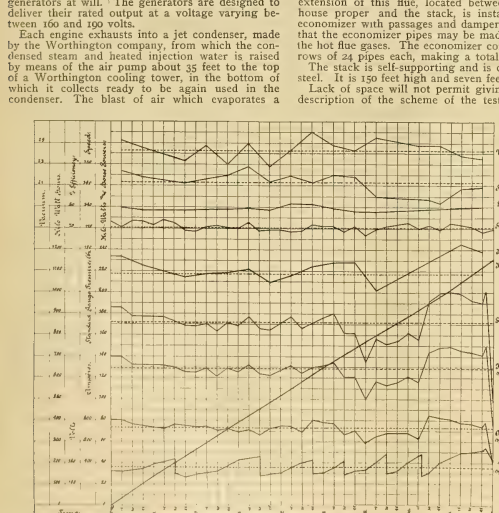


FIG. 2 EFFICIENCY TEST ON THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE-BATTERY ROAD.—GRAPHICAL LOG OF POWER-HOUSE TEST, NOVEMBER 26, 1897.

A typical graphical log of the boiler tests is shown by Fig. 1, which gives a comprehensive record of the data obtained on the last test made November 26, 1897, while the data obtained on the engines and generator during the same time are plotted in Fig. 2. These logs, taken in connection with Tables I. and II. of results give a complete record of the power-house performance on that day.

TABLE I.

RESULTS OF BOILER TESTS.

ITEMS.	Units.	
Number of trial		3
Date of trial, 1897		Nov. 26th
Duration of trial	hours	9
Number boilers in operation		1
State of weather		Rainy
Dimensions.		
Kind of boiler		Heine horizontal tubular.
Dimension of shell, diameter and length		48"x19'6"
Number and diameter of tubes		87–3½
Grate surface 84" wide, 78" long, area	sq. ft.	45 5
Water-heating surface	sq. ft.	1,407
Ratio of water-heating surface to grate surface	sq. ft.	30 9
Average Pressures.		
Steam pressure in boiler, by gauge	lbs.	168 3
Absolute steam pressure	lbs.	183.0
Force of draft in inches of water at stack	in.	.58
Force of draft in inches of water at boiler	in.	.52
Average Temperatures.		
External air	deg.	30 0
Fire room	deg.	45.3
Steam	deg.	374 1
Feed-water	deg.	192.0
Fuel.		
Kind of coal		Fairmount, W. Va.
Total amount of coal consumed	lbs.	7,000
Moisture in coal	%	6.32
Dry coal consumed	lbs.	6 558
Total refuse, dry	%	13.74
Total combustible (dry weight of coal less refuse)	lbs.	5,658
Dry coal consumed per hour	lbs.	728 6
Combustible consumed per hour	lbs.	628 4
Calorific power by calorimeter, per lb	B.T.U.	10,145
Theoretical evaporative power from and at 212 deg. Fahr. in 10 pounds water per pound coal		10 51
Results of Calorimetric Tests.		
Quality of steam, dry steam being taken as unity	%	995
Percentage of moisture in steam	%	5
Water.		
Total weight of water pumped into boiler and apparently evaporated	lbs.	13 410
Water actually evaporated, corrected for quality of steam	lbs.	43.323
Factor of evaporation		1.07
Equivalent water evaporated into dry steam from and at 212 deg. Fahr		46.366
Equivalent water evaporated into dry steam from and at 212 deg. Fahr. pr. hr.	lbs.	5,150.6
Economic Evaporation.		
Water actually evaporated per lb. of dry coal from actual pressure and temp	lbs.	6.00
Equivalent water evaporated per lb. of dry coal from and at 212 deg. Fahr	lbs.	7 06
Equivalent water evaporated per lb. of combustible from and at 212 deg. Fahr.	lbs.	8 22
Commercial Evaporation.		
Equivalent water evaporation per lb. dry coal with one-sixth refuse at 70 lbs gauge pressure, from 100 deg. Fahr	lbs.	5.96
Rate of Combustion.		
Coal square feet grate surface per hour	lbs.	16 0
Consumption of dry coal per hour, coal assumed with one-sixth refuse—		
Per square foot grate surface	lbs.	16.74
Per square foot water htg. surface	lbs.	534
Rate of Evaporation.		
Water evaporated from and at 212 deg. Fahr. per square foot htg. surface pr. hr.	lbs.	3.66
Water evaporated per hour from 100 deg. Fahr. into steam of 70 pounds gauge pressure—		
Per square foot grate surface	lbs.	98.46
Per square foot water htg. surface	lbs.	3 13
Commercial Horse Power.		
On basis of 30 lbs. water per hour evaporated from 100 deg. Fahr. into steam of 70 lbs. gauge pressure equals 34½ lbs from and at 212 deg.	H. P.	149
Horse power, builders' rating at 7 square feet of heating surface per horse power		200
Per cent. developed below rating	%	29 5
Efficiency.		
Percentage of total calorific power utilized	%	62 86

The coal, containing 10,145 British thermal units per pound, had a theoretical evaporative power of

$$\frac{10{,}145}{965.7}$$

or 10.5 pounds of water per pound. The evaporation from and at 212 degrees actually obtained per pound of dry coal was 6.6 pounds. Therefore the efficiency of the boiler and furnace was

$$\frac{6.6}{10.5}$$

or 62.86 per cent. This low efficiency is to be explained in part by the fact that the boiler was 26 per cent. underloaded. The equivalent evaporation per pound of combustible was 8.22, so that the efficiency of the boiler alone becomes

$$\frac{8.22}{10.5}$$

or 78.3 per cent. The boiler then loses by radiation, convection, and through the escaping gases 21.7 per cent. of the original heat units, while the furnace is to be charged with 15.44 per cent. of the lost heat, and 62.86 per cent. appears in the steam.

The economizer did not give satisfactory results on the test shown. This is not the fault of the economizer, however, but is due rather to the unfavorable conditions under which it was installed and is operated. Several large cracks in the brickwork flue leading from the uptakes of the boilers to the economizer on the outside of the power house allow air to infiltrate to such an extent that the flue gases are cooled fully 100 degrees before reaching the economizer. In spite of this fact, however, the economizer upon some of the other tests effected an economy of seven per cent., as figured from the gain in temperature of the feed-water. A graphical log of the boiler test made November 5th is shown in Fig. 3, which indicates a rise of 75.7° F. in the feed-water due to the action of the

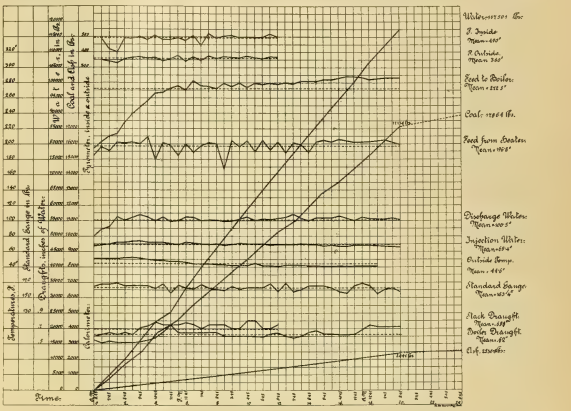


FIG. 3. EFFICIENCY TESTS ON THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE-BATTERY ROAD.—GRAPHICAL LOG OF BOILER TEST, NOVEMBER 5, 1897.

economizer. This log also shows the amount of coal required for banking the fires over night. Upon this test, however, a larger amount of coal was burned in the boilers, and thus a greater amount of flue gases passed about the economizer pipes. During the latter part of the test on November 26th the economizer was cut out of service.

The pumps used 14.36 per cent. of the water evaporated by the boilers. The feed-water, however, was heated by the pump exhaust from a temperature of 97.4 degrees Fahrenheit to a temperature of 202 degrees Fahrenheit, resulting in a theoretical gain of

$$\frac{100\ (202-97.4)}{1{,}196.5+32-97.4}$$

or 9.25 per cent. The actual amount of fuel, then, vacuum was but 24.25 inches. The engines were also overloaded during the entire run and were operated at 363 instead of 380 revolutions per minute. The difference in the power developed by the two lines of cylinders is due to an improper adjustment of the cut-off on the north line. With a few changes there is no doubt but that a material improvement can be made in the duty of the engines.

The indicator cards taken with one engine operating one generator, running on open circuit, show a friction load of 32.26 indicated horse power. This is but 14.86 per cent. of the average 217 indicated horse power, and is a very satisfactory figure.

The average efficiency between the horse power developed in the cylinders and the electrical power delivered on the switchboard is shown to be 79.27 per cent., which is also satisfactory.

The commercial efficiency of the generator (including the leads to the switchboard) at this load is

$$\frac{79.27}{85.14}$$

or 93.1 per cent., which is all that can be expected

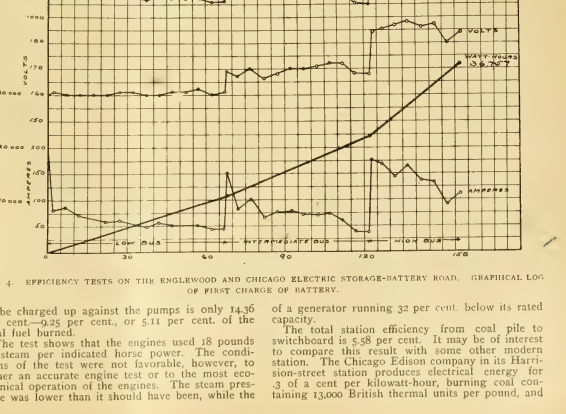


FIG. 4. EFFICIENCY TESTS ON THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE-BATTERY ROAD. GRAPHICAL LOG OF FIRST CHARGE OF BATTERY.

to be charged up against the pumps is only 14.36 per cent.—9.25 per cent., or 5.11 per cent. of the total fuel burned.

The test shows that the engines used 18 pounds of steam per indicated horse power. The conditions of the test were not favorable, however, to either an accurate engine test or to the most economical operation of the engines. The steam pressure was lower than it should have been, while the

of a generator running 32 per cent. below its rated capacity.

The total station efficiency from coal pile to switchboard is 5.58 per cent. It may be of interest to compare this result with some other modern station. The Chicago Edison company in its Harrison-street station produces electrical energy for .3 of a cent per kilowatt-hour, burning coal containing 13,000 British thermal units per pound, and

trosting delivered $1.05 per ton. The efficiency of that station, therefore, is

$$\frac{1.05\times1,000\times3.43\times100}{.003\times2,000\times13,000}$$

or 4.61 per cent. This indicates that the net efficiency of the plant tested is 20 per cent. better than that of the Edison station. The Edison station has an output of over 3,000 horse power, while the Englewood station has a maximum capacity of 500 horse power, which makes the comparison more striking.

The cost of fuel for a net kilowatt-hour on the switchboard is shown in the following table:

TABLE II.

RESULT OF TESTS ON ENGINES, GENERATORS AND AUXILIARIES.

ITEMS.	Units.	
Number of test		Nov. 26th
Date of test		9
Duration of test	hours	
Water.		
Total water handled by pumps	lbs.	43 440
Water used by economizer engine	lbs.	350
Water used by stoker engine	lbs.	530
Water used by air and feed pumps	lbs.	6,240
Water used by calorimeters	lbs.	90
Water escaping through leaks, estimated liberally two per cent. total	lbs.	868
Water not used by engine	lbs.	7,880
Per cent. total water not used by engine	%	18.12
Per cent. total water used by pumps	%	14.39
Total water used by engine	lbs.	35,560
Per cent. moisture in steam at engine	%	1.20
Total dry steam used by engine corrected for moisture	lbs.	35,133
Average dry steam used by engine per hour	lbs.	3,903
Engines.		
Average speed of engine		361
Average vacuum	in.	24 25
Average gauge pressure	lbs.	171.3
Average indicated horse power		277
Maximum indicated horse power		246
Minimum indicated horse power		202
Total indicated horse power hours		1 951.8
Pounds dry steam per indicated horse power hour		18
Dynamo No. 4.		
Average volts		176.5
Average amperes		732.0
Average kilowatts		128.3
Per cent. of full load		67.5
Total kilowatt-hours output		1,154.7
Average kilowatt output		128.3
Total kilowatt-hour output		1,154.7
Total electrical horse power hours		1,547.8
Maximum kilowatt output		156.48
Load factor (average watts divided by maximum watts)		.82
Watts used by cooling tower motor		7,568
Kilowatt-hrs. used by cooling tower motor		68.1
Net kilowatt-hour output		1,086.6
Efficiencies.		
Average efficiency E. H. P. divided by I. H. P.		70.3
Pounds water evaporated per indicated horse power hour		22.25
Pounds coal burned per indicated horse power hour		3.58
Pounds water evaporated per net kilowatt-hour		40.0
Pounds coal burned per net kilowatt-hour		6.44
Indicated horse power hour per lb. coal		.298
Watt hours per lb. coal		155.2
Costs.		
Coal per ton		$1.90
Total cost of coal burned		6.69
Cost of coal per net kilowatt-hour		.00615

TABLE III.

BATTERY MILEAGE.

No. of Battery.	—November 5th.— No. of Trips.	Miles Run.	—November 26th.— No of Trips.	Miles Run.
1	2	33.0	...	.....
2	2	22.4	...	.....
3	4	66.9	3	44.5
4	1	11.8	3	66.9
5	5	100.7	2	33.9
6	4	67.2	5	56.6
7	4	68.4	6	77.0
8	...	.....	...	.....
9	3	43.6	3	41.4
10	5	49.5	4	53.7
11	...	.....	5	58.6
12	5	70.6	...	.....
13	1	11.5	6	68.1
14	...	23.0	...	.....
15	1	11.5	5	77.8
16	...	.....	...	.....
17	...	.....	...	.....
18	...	.....	...	.....
19	...	11.5	4	62.2
20	...	.....	5	56.9
21	5	80.2	2	34.2
22	5	79.0	4	55.4
23	1	10.6	...	.....
24	...	.....	...	.....
25	3	47.1	3	57.2
26	5	79.6	2	22.4
27	1	10.6	4	57.2
28	1	11.8	3	50.6
29	4	79.0	4	56.3
30	4	73.9	4	31.2
31	2	48.4	...	.....
32	6	68.1	...	.....
33	4	79.3	1	56.2
34	4	78.1	2	34.2
35	...	.....	6	84.9
36	...	.....	3	78.7
37	3	67.8	3	35.1
38	4	81.6	4	80.0
39	...	.....	...	.....
40	...	77.8	5	67.8
41	4	80.1	6	90.2
42	4	68	3	34.6
43	2	22.6	4	44.1
44	4	80.2	3	34.2
	110	1,821.8	124	1,668.4
Average miles each trip		16.56		13.50

switchboard is shown to be .611 cent. This high price is to be explained, then, not by the inefficiency of the station, but by the fact that a high price is paid for a poor coal. With a more advantageous arrangement in the purchase of coal there is no reason why this station should not develop a kilowatt-hour for less than .3 cent.

II. DATA ON BATTERIES OBTAINED AT TIME OF POWER-HOUSE TESTS.

Two complete power-house tests made on November 5 and November 26, 1897, showed the amount of coal required to deliver a kilowatt-hour upon the switchboard. At the same time a complete log of the operation of the battery-charging pit was kept, which shows the history of each battery for the entire time of the test. In the test made November 5th the batteries were charged by the "three-voltage" method, but on November 26th the station was operated with one generator, and but one voltage was used to charge the batteries. During the latter part of this test the tracks became covered with ice, due to a sleet-storm, and it became necessary to change the batteries every half trip, which will account for the shorter time of charging indicated upon the latter part of the power-station log of the test, and also the smaller average number of miles per trip shown November 26th. The data obtained at the charging tables was checked up with the conductors' reports. These reports show the number of the car, the time occupied by each trip, the length of the run, and the number of the battery used. Table III. shows a summary of this information for the two days. This table shows the battery mileage for each day from the time of starting the road in the morning until the last trip at night. The cars are started out in the morning before the power plant begins to operate, using batteries charged the night before. No record of the energy used by these first trips was obtained, but the power required to charge an equal number of batteries for use the next morning after the test, appears in the result, so that no error results from this omission.

This table shows the actual number of miles which the batteries ran the cars on the two days. In addition to this, batteries were used to operate the auxiliary motors of the plant. These motors are upon the transfer carriage used to handle the batteries in the charging pits and upon the transfer carriage used to move the cars in the car barn. No record was obtained of the power used by these motors. A recording wattmeter was secured to operate in this auxiliary circuit, but unfortunately it was injured in transportation and could not be used. An effort was made to obtain an average value of the power used for each operation, by means of readings made at intervals of two seconds upon standard volt and ampere meters, but owing to the sudden fluctuations the data obtained was unsatisfactory. However, as the power used in the operation of handling the batteries and the cars in the barn may properly be charged to the operation of the cars, the total amount of energy delivered to the charging tables divided by the actual car mileage will give the total power required per car-mile. With the data at hand, however, this entire energy cannot be exactly divided into the amount used in the barn and the amount used on the road. The former amount will be a very small proportion of the latter, but this proportion will increase as the average length of battery trips decreases.

The power delivered to the switchboard and the amount of coal required upon November 5th is shown in the records of the test made that day. The power delivered upon November 26th was obtained for nine hours from the records of the test made from 3 p. m. to 12 p. m., and for the remainder of the day from the charts of the recording ammeter. The readings of this ammeter were carefully compared with the readings upon a standard ammeter, and found to be correct. These ampere readings were multiplied by the value of the average voltage found upon the test made that day, and the resulting watts added to those obtained during the test.

The following table shows a summary of the results of the two day's run:

	Nov. 5th	Nov. 26th
Date of test		
State of weather	Rainy	Rainy and cold
Kilowatt-hours delivered to switchboard	2,638.	2,895.
Kilowatt-hours used by cooling tower motor	151.	174.
Net kilowatt-hours delivered to charging bus-bars	2,487	2,721
Total number of car-miles	1,821.8	1,668.4
Kilowatt-hours on switchboard per car-mile	1.37	1.63
Pounds coal per net kilowatt-hour	6.9	6.44
Pounds coal per car-mile	9.43	9.50
Cost coal per ton	$1 90	$1.90
Cost coal per net kilowatt-hour	.0065	.00611
Cost coal per car-mile	.00897	.00900

It will be noticed that although the cost of a kilowatt-hour upon the switchboard was less in the second test, the cost of fuel per car-mile the same day was something more than in the test November 5th. This result is due to the fact that the kilowatt-hours required per car-mile were greater in the second case. The difference in the amount of energy required per car-mile is to be explained by the presence of a coating of ice upon the rails during the latter part of the day (November 26th). It is unfortunate that a freezing sleet-storm should have occurred at this time, though the results of the test indicate to a certain extent the amount of power required to operate the road under adverse conditions. Owing to the storm, the results of the two tests do not furnish a fair basis for a comparison of economy of the two different methods of charging the batteries.

The coal used upon both tests contained 10,145 British thermal units per pound and cost $1.90

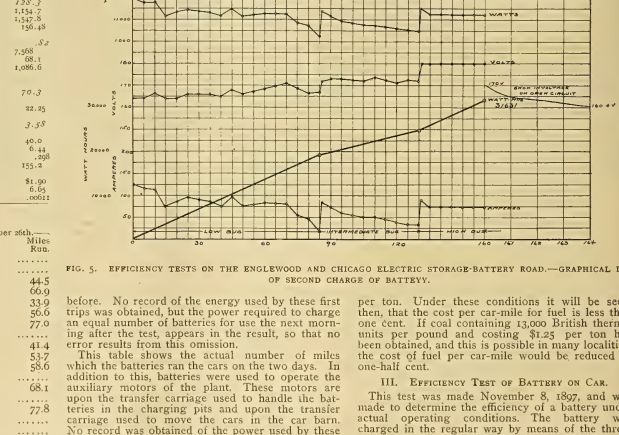


FIG. 5. EFFICIENCY TESTS ON THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE-BATTERY ROAD.—GRAPHICAL LOG OF SECOND CHARGE OF BATTEYY.

per ton. Under these conditions it will be seen, then, that the cost per car-mile for fuel is less than one cent. If coal containing 13,000 British thermal units per pound and costing $1.25 per ton had been obtained, and this is possible in many localities, the cost of fuel per car-mile would be reduced to one-half cent.

III. EFFICIENCY TEST OF BATTERY ON CAR.

This test was made November 8, 1897, and was made to determine the efficiency of a battery under actual operating conditions. The battery was charged in the regular way by means of the three-voltage method. It was then discharged while making a round trip, and was then placed upon the charging table and again charged, thus giving two charges and one discharge to determine the efficiency. The battery used was one which had operated at that time over 8,000 miles, and was taken for the purpose of this test immediately after it had made a trip similar to the one upon which it was tested.

The current and voltage upon the two charges were obtained by means of standard Armour Institute instruments, and readings were taken every five minutes. The data is shown plotted graphically in Figs. 4 and 5, in which the abscissæ represent time in minutes.

The observations made upon the car while the battery was discharging consisted in taking voltage and ampere readings every five seconds, while the car was in motion, the time between stops and the length and location of each stop, and a continuous record of the speed.

The voltmeter was a standard Weston instrument from the Armour Institute, and was connected across diagonal corners of the battery tray. Each set of batteries consists of 72 cells, arranged in four groups of 18 each. Each cell contains nine plates—four positive and five negative. The negative plates are of the "chloride" type. The positive plates are of the "Manchester" type. The batteries were furnished by the electric Storage Battery company of Philadelphia. Each plate is 14⅜ inches long

and 7¾ inches wide. The negative plates are one-fourth inch and the positive plates are five-sixteenths inch thick. The outside dimensions of the hard rubber containing jar are 5¼ by 8½ by 17¾ inches deep. The weight of the lead elements of each cell is 75 pounds, of the jar five pounds and of the electrolyte 20 pounds, making a total weight for each cell of 100 pounds. Each group of 18 cells is provided with separate contact plates, which are connected by means of cables to the controller. The controller has five points and allows the following combinations:

1. The four sets of batteries in parallel.
2. Batteries in series parallel in sets of two.
3. Batteries in series with resistance.
4. Batteries in series without resistance.
5. Same as No. 4 with field of motor shunted.

The voltmeter was so connected that it gave the voltage at the battery terminals for each combination. The car tested was 20 feet long in the body, 30 feet long over the platforms, and had a seating capacity of 28 passengers. The car weighed 13½ tons with the batteries, the batteries and trays adding about four tons to the usual weight of a car of that size.

The motor upon the car was a 50 horse power Walker four-pole series motor. The entire current used at any one time passed through the armature, so that the ammeter was inserted in the positive brush leads. The ammeter used was of the round-pattern Weston type, and had been found to be correct by comparison with an Armour Institute standard. Five observers were used to obtain the ammeter and voltmeter readings; one called the time every five seconds, two read the instruments, and the other two kept the records. At times of starting the instruments were read oftener than at five-second intervals. A trial trip was made with another battery to get the observers acquainted with their positions, and as the fluctuations in the current were not violent nor many, it is believed that the results represent very nearly the actual facts.

The duration of the stops and the time the car was in motion between stops was obtained by means of a stop watch.

The record of speed was obtained by means of a Boyer speed recorder belted, by means of a flexible belt, to the car axle. By means of pressing lightly upon the recording pencil a dot was made in the speed curve every five seconds.

The record of the speed recorder has been transferred to a larger scale and is shown in Fig 6. The same diagram has been used to show the kilowatt-hour and elapsed-time curves. No attempt was made to indicate upon this diagram the ampere or voltmeter readings, as this information is given upon a larger scale in the acceleration tests.

The test may be divided into four parts as follows:

	Distance, Miles.	Time, Min. Sec.	No. of stops.	Av. speed miles per hour.
1. Power house to Blue Island	5.9	28.20	12	12.5
2. Blue Island to power house	5.91	29.55	19	11.8
3. Power house to Sixty-third St.	5.3	27.40	13	11.5
4. Sixty-third St. to power house	5.3	27.50	13	11.5
	22.44	113.45	57	11.84

Length of one back-up, stop 18..... .04 mile

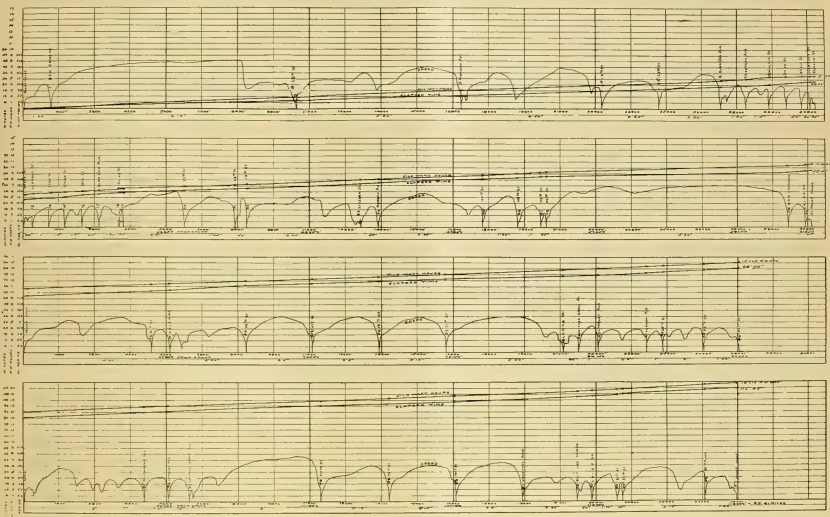


FIG. 6. EFFICIENCY TESTS ON THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE-BATTERY ROAD. GRAPHICAL LOG OF BATTERY DISCHARGE AND SPEED OF CAR.

In making the stops an effort was made to approximate actual service and in every way reproduce the conditions of an actual trip. No regular passengers were carried, however, the load consisting of nine observers, the motorman and conductor. The motorman was instructed to follow his usual custom of coasting where possible. The track was dry for the first two parts of the test, but during the last two parts it was raining and the tracks were wet. The energy taken from the battery was as follows:

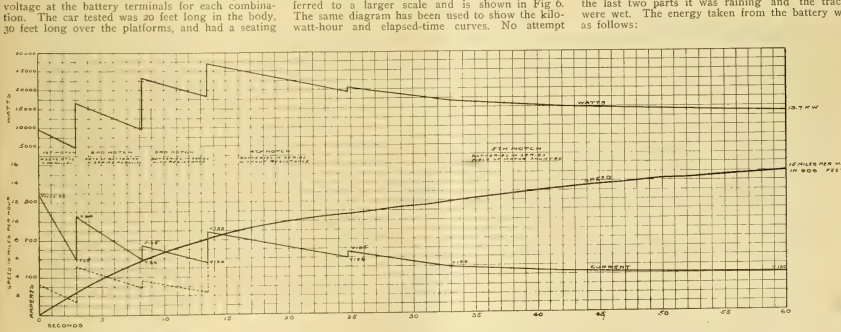


FIG. 7. EFFICIENCY TESTS ON THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE-BATTERY ROAD.—GRAPHICAL LOG OF ACCELERATION TESTS.

	Distance. Miles.	Watt-hours	K. W. hours per car-mile.
1. Power house to Blue Island	5.9	5,533.1	.920
2. Blue Island to power house	5.94	5,098	.868
3. Power house to Sixty-third street	5.3	4,394.6	.820
4. Sixty-third street to power house	5.3	4,689.6	.885
Total	22.44	19,715.3	.878

[*Continued on page 81.*]

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Subscribed and sworn to before me this 9th day of July, 1897.
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Boston is the storm center this week, and the good people of the Hub are going through a pretty hard siege according to the accounts that reach the outside world. The Chicago Tribune on Wednesday contained an announcement that "all telegraph wires connecting Boston with the outside world were disabled by the storm," and the further explanatory line that its account of the storm, which was dated at Boston, was received "by long-distance telephone." The electrical interests generally were badly crippled. There were some interesting features which serve to illustrate the condition of affairs throughout the East. A dispatch from New York says that owing to the storm and the condition of the telegraph lines all business between Boston and New York was practically suspended. "Every message from Wall street to Boston had first to be cabled to London and then sent back to Boston. This method of communication was both tedious and expensive, and in the majority of cases Boston business was practically suspended." It seems rather strange that our eastern friends did not avail themselves of the long-distance telephone lines.

Corporation laws are generally obnoxious, as is all other class legislation, and it sometimes happens that when these statutes cannot be evaded easily the big corporations ignore them until they are enforced by officials. This was the case in Kentucky, and now the Franklin County grand jury has made a report filing 121 indictments against the chief corporations doing business in the state for failing to report to the secretary of state in order that a franchise tax may be assessed against them by the State Board of Valuation and Assessment. The penalty for such failure is $1,000 and $50 a day in addition for each day the corporations have failed. Not one of the corporations indicted has reported since 1893, or since the corporation law went into effect, it is said. Prominent among the companies named are the principal electric corporations throughout the state, including the Western Union Telegraph company, the Louisville street-railway companies and similar companies in Covington, Newport, Lexington, Frankfort, Paducah and Owensboro, electric-light companies in Ashland, Frankfort, Paris, Lexington, Carlisle, Owingsville, Owensboro, Richmond, Maysville, Hopkinsville, Paducah and Hardrodsburg; and the telephone companies in all parts rodsburg, and the telephone companies in all parts be tested when the matter is taken into court.

Fighting fire with fire is the plan suggested by Mr. Doherty of Madison as a solution of the question of municipal ownership of electric-lighting plants. He calls attention to the fact that much of the trouble experienced by central-station managers who have street-lighting contracts is brought about by those who propose to operate municipal plants in conjunction with city waterworks. It has been contended that when cities engage in electric lighting part of the actual cost of operation is charged to other departments. In Chicago it is now admitted that the Fire Department carried a goodly portion of the expense, while in smaller towns the waterworks usually bear this burden. It is almost impossible for an outsider to separate the items of cost, and those directing the plants have no desire to do so. As a result the public is misled and false statements of expense are circulated. Mr. Doherty's remedy is to show that, according to the admissions of city officials, the waterworks are not operated as economically as they could be. In support of this view central-station companies are advised to propose leasing the waterworks wherever trouble of this kind arises, and thereby show that they can effect a saving in this service in keeping with that which the advocates of municipal-lighting plants claim is possible by their plan. The suggestion is worthy of serious consideration.

We have already alluded to the contemptible trick to which the publisher of an eastern electrical journal resorted in circulating among advertisers a fac-simile letter purporting to be addressed to him by a manufacturing concern in which serious reflections were made upon the other electrical publications of the country. It only remains to be added that investigation of the matter revealed the fact that the circulars issued by W. J. Johnston—who, of course, was at the bottom of this scheme —were entirely false and malicious, and even misrepresented the agent of the company whose services were enlisted. The president of the manufacturing company mentioned has repudiated the statements of his subordinate, and in a letter to the Western Electrician expresses his regret that such unauthorized use should be made of the company's name and his disapproval of the entire proceeding. It is significant, too, that as soon as the matter was brought to the attention of the company, Mr. Johnston was peremptorily ordered to withdraw the offensive document from circulation. A complete statement of the facts in the case over the signatures of presidents of the other electrical publishing companies is now being circulated. It tells the story of the last of Johnston's tricks in a straightforward, dignified manner, and thoroughly exposes the disreputable Johnston methods of which this is a fair specimen. It is a severe arraignment, but is well deserved.

It is proposed to make the forthcoming electrical exhibition at New York more than a mere display of commercial apparatus, such as generally constitutes an industrial show. The management, with the co-operation of the New York Electrical society and a committee of eminent electrical engineers, has undertaken an educational feature that promises excellent results. This determination cannot fail to enlist the active support of every person interested in electrical advancement, and it ensures, moreover, a standing and consideration for the enterprise that it could not otherwise command. The work of preparation for the event is certainly in competent hands, and no doubt the expectations of the fraternity and the public generally will be fully realized. The service which the New York Electrical society will render in this instance will be in keeping with its admirable record as a public-spirited association. It has already done much to entitle it to consideration and respect, and has placed the electrical fraternity of the country as well as the city of New York under lasting obligations for promoting and encouraging scientific work and engaging the attention of the general public to the advancement made in this field.

Whatever views may be entertained upon the advisability of permitting overhead trolley wires to be placed in crowded city streets, especially in the downtown business district, there is unanimity of opinion upon the advantages gained through the extension of the electric lines into the suburban districts. It is hardly necessary at this late day to direct attention to the benefits bestowed upon the mass of workers who are no longer compelled to live in overcrowded and otherwise unsuitable quarters, huddled together without regard to comfort, convenience or decency, but are now enabled to secure homes away from the noise, dirt and confusion of the city. The competition of the trolley has made the steam roads improve their suburban service and reduce the fare charged upon their lines. This has been particularly noticeable throughout New England and the Atlantic states and in Chicago. The subject has attracted the attention of steam-railroad men and has brought forth much discussion. The New York, New Haven and Hartford Railroad company has suffered greatly from competition of trolley lines, and has bitterly contested every point with the electric system, but it has finally resulted in victory for the newcomer.

In the West the Chicago and Northwestern company has earned the distinction of being the most active fighter of electric lines. Last summer finding that the Evanston trolley line was making inroads on its revenue from suburban traffic, it made material reductions in its fares and improved its service. Later an electric line, with the aid of a "bus" service, introduced cheap fares between Aurora and Geneva, and the Northwestern was compelled to reduce rates and increase the number of trains. The latest move of the steam road is the greatest concession yet made to the electric system. The Northwestern announces that it has purchased a parallel line which, when completed, will extend from Appleton to Fond du Lac, Wis. The company has also an option on the Appleton electric street-railway line which is to be built to Fond du Lac on the south and DePere on the north, and if it buys the road it will abandon many trains between Green Bay and Fond du Lac and handle the business by the electric line. The Fox Valley towns will all sooner or later be connected with the electric lines. There is already a road from Aurora to Carpentersville, finely equipped and doing business. The Appleton line is said to be projected to link such towns as DePere, Wrightstown, Little Rapids, South Kaukauna, Combined Locks, Little Chute, Kimberly, Appleton, Neenah, Oshkosh and Fond du Lac. The Appleton plant is an old one and has only recently emerged from the hands of a receiver, but the Northwestern people have determined that they must meet the conditions and furnish the service demanded or see the suburban business pass into other hands. The experience of the steam railroads between St. Paul and Minneapolis is still remembered.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone Exchange company is increasing the number of wires between Minneapolis and Litchfield to relieve the rush on the present wires.

Madison Lake, Minn., wants telephone connection with neighboring towns.

The Dakota Central Telephone company will extend its lines to Watertown, S. D., in the spring.

At the annual meeting of the telephone company at Rush City, Minn., it was decided to reinforce the line from Danewood to Grass Lake and make it permanent.

A local telephone company has been formed at Litchfield, Minn., to cover the county. A local telephone exchange is in prospect for Graveville, Minn.

The long-distance company's wires between Sioux Falls, S. D., Sioux City, Ia., and Yankton, S. D., are now in operation.

The application of the Minnesota Central Telephone company of Willmar, Minn., for admittance to Minneapolis, which is backed by the independent telephone companies of the Northwest, is being warmly seconded by a number of the newspapers of Minneapolis and the smaller places. The jobbers of Minneapolis are anxious to have the connection made, for it will open to them a field which they have been unable to reach heretofore save by telegraph.

Hulburd & Johnson of Morris, Minn., are arranging to put in a local telephone exchange at Morris, Minn.

The Rocky Mountain Bell Telephone company will extend its lines from Missoula, Mont., to Wallace, Idaho, and will make connection between Great Falls and Augusta.

A telephone company has been formed at Ellendale, N. D., to put in a system to cover Dickey County.

A telephone company has been formed at Manitowoc, Wis., to run a line from Manitowoc, Wis., to Brillion, via Cato.

The independent telephone companies of Northeastern Iowa propose an anti-Bell alliance at La Crosse, Wis., by which several hundred towns in Iowa and Southern Minnesota shall be connected at a uniform rate of 15 cents per message, whether the distance be 10 miles or 200. The deal will probably go through.

The Northwestern Telephone Exchange company has now connection between Minneapolis and Sioux City, Ia., and by way of Albert Lea to several hundred towns in eastern, central and western Iowa. The company has built about 1,000 miles of line this season.

People of Lowry, Minn., want telephone connection with Alexandria, Minn., and are forming a company for the purpose.

Nolan & Hebden will build a telephone line from Minocqua, Wis., to their summer resort on Squirrel Lake in the spring.

E. M. Walsh of the independent telephone company of Fisher, Minn., says his lines will be extended to Grand Forks and Crookston, Minn., in the spring.

The Chequamagon Bay Telephone company of Ashland, Wis., has arranged for a telephone concert to be give February 19th, for its patrons. The Boston Opera company will give an entertainment in Eau Claire and the music will be transmitted to Ashland. This company has recently awarded contracts for constructing telephone exchanges in Ashland, Bayfield, Washburn, Iron River, Ironwood, Bessemer and Hurley. Long-distance lines will be extended to Duluth and Superior, with branches to other points.

O. F. Burlingame has been appointed manager of the Eau Claire Telephone company's exchange at Eau Claire, Wis.

The Eastern Wisconsin Telephone company has been incorporated at Elkhart Lake, Wis., to operate a telephone system in Sheboygan County.

The Northwestern Telephone Exchange company will string another wire between Fargo, N. D., and the Twin Cities, as the present wire cannot handle the business.

The American Telephone and Telegraph company has connected with Burlington, Ia.

H. L. Sumption and Irving Todd, Jr., have been granted a franchise for a telephone exchange at Hastings, Minn.

The Mississippi Valley Telephone company has finally been granted the privilege of stringing its wires through Fort Madison, Ia., to connect its Burlington and Keokuk exchanges.

The Madison (Wis.) Journal is authority for the statement that there are over 60 telephone companies operating in the state of Wisconsin.

The report of the condition of the Southwestern Wisconsin Telephone company of Dodgeville, Wis., shows receipts and earnings of $1,040 and disbursements of $644. Repairs, improvements and extensions have been made to the extent of $1.777 There was $950 realized from sales of stock

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Manufacturers of telephone apparatus will be interested in the following announcement by T. J. Corrigan of Monticello, Ark.: "We are contemplating putting in a telephone system here, also a country line. We have a franchise for the town and I think that I can get about 50 subscribers if I get a country line. This is a great cotton town and does lots of business, and it is really necessary to have telephones."

Effect of Long-distance Telephony on Railroad Travel.

In a recent issue of the Western Electrician was noted the statement of President Callaway of the Lake Shore railroad admitting that the growing use of the long-distance telephone was cutting into the passenger business of his road. Since then the subject has been taken up by the New York Tribune, which has interviewed a number of prominent steam railroad men and others.

Chauncey M. Depew is quoted as follows: "There is no doubt that the long-distance telephone is affecting short-distance railroad travel to a considerable extent. By short-distance travel I mean that within 100 miles or less of the cities. One reason is that manufacturers who used to communicate with their stores and offices in the cities by messengers or by some member of the firm or corporation going to and fro frequently, now find that they can do business as well and with a saving in time by using the telephone. Then the country merchant who used to go to town once a week to replenish his stock finds that he can replenish it daily, if need be, by using the telephone, according to the demands of his business. Thus he does not have to carry so large a stock, but lets the wholesaler carry it for him. His wife knows this, and so he no longer has a good excuse for going to town often. These I look on as the regular sources of railroad travel that are cut off by the long-distance telephone. Now for the irregular sources. Social communications over short distances are now performed to a large extent by means of the telephone. The shopping business is another important factor. Take people living within 25 or 30 miles of a good-sized city; they mostly have telephones in their houses, and instead of going in for shopping purposes at short intervals they call up the stores by telephone, and only go shopping in person occasionally. Then if we take places like Syracuse, Rochester, Utica, Albany and their outlying districts, we find that a good deal of business is done by telephone, and much railroad travel for short distances is saved to the people. All these things taken together show that a large amount of business is thus cut off from the railroads. But the increase of population is making up for the loss thus occasioned. In other words, the telephone keeps the factories at the little places, while the main offices are in the larger ones. It is so with all inventions; at first they seem to be injurious to certain interests, but ultimately they prove of advantage all around."

All railroad men, however, do not agree with Mr. Depew and Mr. Callaway. At the office of the Erie railroad in Cortlandt street, the inquirer was referred by President E. B. Thomas to D. I. Roberts, the general passenger agent of the company, as the man best qualified to give information on the subject. Mr. Roberts, when seen, expressed surprise at Mr. Callaway's statement, and said that there was nothing in the experience of the Erie people to justify it. "This matter was first called to my attention three or four weeks ago," Mr. Roberts went on, "and I said then that I did not think it possible for the telephone to have affected the business of the railroads to any extent. I was amused as well as surprised when I read what Mr. Callaway is quoted as saying, and I do not see where he gets the evidence for such a statement. Certainly the passenger business is not languishing with us." Mr. Roberts called for the records showing the business of the company to western points for November, 1897, and made a comparison with that done during the same month in the previous year, showing that the number of passengers carried to Chicago and other points west of Buffalo and Pittsburg was more than 1,000 larger in 1897. "Even if there had been a falling off," he continued, "I do not see how any one could positively say that it was due to the increasing use of the long-distance telephone. Undoubtedly there are cases where a man talks over the wire and so saves a railroad trip, but they are too few to make any difference in railroad receipts that is worth considering. Long-distance telephoning is too costly, for one thing, and business men do not care to trust important matters to a telephone. They can never be absolutely certain that they are talking with the right man anyway, although it is possible to recognize a man's voice over a long distance. Now it costs $9, I believe, for a five-minutes' conversation with Chicago. For a man to go to Chicago would cost $50 at least, to say nothing of his time. That amount would give him 25 or 30 minutes' talk on the telephone. But when a man goes to Chicago on business it is likely to be of sufficient importance so that he has to see 10 or a dozen men, and if he should call each of them upon the 'phone he would soon pay more than his railroad fare. I don't know of men doing this. Of course, there is a saving of time in telephoning, for one can get an immediate answer, and I can easily see how the telephone might interfere with the use of the telegraph. But in the city important business matters are not done by telephone; it is only details that are looked after in that way, and details at a distance can be arranged by mail. I know that for my part I would not give an important order or transact any important business over the telephone. One might be talking with the right man, but there could be no absolute certainty of it, and there is too much danger of other people hearing what is said."

When Samuel Sloan, president of the Delaware Lackawanna and Western railroad, was called on at his office, in Exchange Place, he said that he had seen Mr. Callaway's statement, but he did not care to say anything about it. So far as he was aware, the business of his company had not been affected by the use of the telephone. His view of the matter was that all improvements of that kind had a tendency to increase business, and the railroads were pretty sure to get their share of the increase. W. F. Holwill, the general passenger agent of this company, was also seen. He said that it was a surprise to him to read what Mr. Callaway had said, or was reported to have said, and that nothing of the kind had been suggested by the experience of the Lackawanna road. Instead of falling off, their passenger business showed a gratifying increase, but if there had been a decline he was unable to see how anyone could attribute it to one specific cause, like the competition of the telephone.

Another railroad man said that in his opinion a great many railroad journeys were saved by men making use of the 'phone, and as an illustration cited this instance: "A friend of mine, who is in the insurance business in a western city, had some important business to transact with a company in Hartford. Sitting at the desk he simply called up the man he wanted on the wire, and in 15 or 20 minutes the business was all cleaned up. He saved his railroad and hotel bills; he saved his time; he saved all wear and tear, and even if the cost of using the 'phone had been more than all his expenses, there would have been a saving all around. I believe there are tens of thousands of such cases every day, and the aggregate must tell largely on the receipts of the railroad companies.

A well-known insurance man, when the subject was suggested to him, cogitated a moment, and then said: "I never thought of the matter before, but now that I do think of it, I feel sure that a good deal of money is thus saved that would otherwise go to the railroads. Whether it is enough to affect railroad earnings appreciably, of course I can't tell. I recall several instances in point. Last winter, for example, I wished to engage a man for an important place in our business, and it was necessary to look up his references in Boston. Formerly I should have made a trip to Boston for the purpose, and spent a good share of a day in visiting different men. Instead of that, I sent a boy to call up the men I wanted to see on the telephone, one after another, and not more than half an hour of my own time was taken in doing the entire business. In a telephone conversation, especially with the long-distance 'phone, one talks right to the point, and there is no chaff or story-telling or anything of that kind. If I had gone to Boston, it would have cost me three or four times as much as the telephone charges, counting hotel expenses as well as railroad fares. But if the use of the telephone had cost more than the fares there would still have been economy in it, for the saving of time was a very important element. It would certainly have taken me away from my business for an entire day. The matter might have been attended to by correspondence, but it was too slow a method, and, besides, in a personal interview one thing suggests another and a subject may be gone into thoroughly. Then we have an agency in Philadelphia, and, now that I come to consider it, I remember that we do not see the manager of it half as often as we used to. But he calls us up on the telephone frequently, and we do business that way, and he only comes over here once or twice a year. The saving in carfares on this account is considerable. I suppose there are thousands and thousands of similar cases in this and other cities, and the aggregate amount of money thus withheld from the railroads must be large."

A business man having large interests in this city also showed surprise when asked whether in his experience the long-distance telephone had any important influence on railroad travel, and then remarked: "It is an interesting matter, surely, but this is the first time I have known it to be put in that way. In my own business, of course, we make very large use of the telephone within the city limits. Without it we would not be able to do as much business as we do, at least without enlarging our force. Telephoning out of town does not come in there at all. But I am connected with a large company, which I do not care to name, which has four factories in two different states. One of them is three hours distant from New York, another five hours, another six hours, and the last eight hours distant. It is important that the city office should be in close communication with the factories, and after every meeting of the executive committee of the directors the factories are called up on the 'phone and instructions given to the managers. Without this means of communication a good deal of traveling would be necessary, though no doubt part of the business would be done by telegraph and mail. Without making an accurate estimate, I should say that at least $4,000 or $5,000 was saved in railroad fares every year, while the cost of using the telephone cannot be more than $1,000 or $1,500. But the chief saving is the matter of time. Suppose it were necessary for the president of this corporation to visit the four factories at frequent intervals; the time it would take would be a serious matter, for when a man gets a salary of $25,000 a year, it is easy to see that his time is valuable. From my observation, though,

it would seem that the long-distance telephone is not used nearly as much as it might be. In the case of the company I am speaking of it required a good deal of persuasion to get them to put one in, for they thought it would be only a toy and not of practical value. After trying it they soon saw the value of it."

It might be supposed that the use of the telephone would have a considerable effect in curtailing travel to the city by men engaged in business in towns near and remote who are in the habit of purchasing goods in New York, but inquiry shows that this is not the case. A question put to a representative of one of the largest dry-goods houses in the city brought out this response: "Of course, we make a good deal of use of the telephone in our business, but most of it is right here in New York. We send 50,000 messages a year over the 'phone, and the proportion of them that go outside is very small. I cannot say just how much it is, but the outside messages include all those to Jersey City, Hoboken, Elizabeth and other near places that are almost a part of the city. While we have a long-distance telephone in every one of our 13 departments, they are little used in receiving orders from customers some distance away. I do not suppose there is more than one such order a day on the average. Suppose a man in a town 300 or 400 miles away wanted to give an order to this house. The chances are that he would want something from several departments; if so, he would have to call up each one separately, and the expense would soon more than equal his railroad fare and hotel bill. Besides, when a merchant of that kind is making his purchases he usually wants to deal with several houses in different lines, all of which he can do in a single day by coming here himself. And then, when he comes in person, he has a chance to look at a variety of samples and get new ideas, to say nothing of the good time which he always counts on in New York. I know that in some parts of the West a great deal of business is carried on by telephone, as for example, between Denver and Leadville, and in such cases money that would go in railroad fares is kept from the railroads possibly in sufficiently large amounts to have some effect upon their earnings; but I see no reason to believe that it is so in the vicinity of New York, at least in the carrying on of the dry-goods business."

Legal Rights of Telephone Companies.

In the United States Court of Appeals at Richmond, Va., on February 1st, Judge Simonton handed down an opinion in the case of the city of Richmond against the Southern Bell Telephone and Telegraph company, involving the validity of the application to the telephone of the act of Congress of 1886, declaring that the streets of a city are post roads of the United States.

Judge Simonton holds that while the act specified

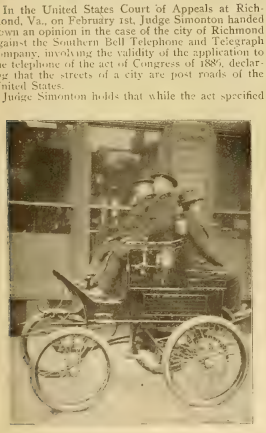


FIG. 1. NEW ELECTRICAL EQUIPMENT FOR VEHICLES.—SIPE & SIGLER ELECTRIC TRAP.

only telegraph companies are entitled to protection under it provisions a telephone line is to all intents the same thing and therefore entitled to the same privileges.

The Bell Telephone companies' charter had expired and the only ground of opposition might be revoked, but was disposed from interfering with the company's poles and wires. The object of the decision is to prevent the city from damaging the company's property, but the city retains the right to control the streets and the poles and wires in the

The contract for all the work in connection with the lighting of the Parliament and departmental buildings at Ottawa, Canada, has been placed with Ahearn & Soper of that city.

New Electrical Equipment for Vehicles.

To state that a company has been organized in Chicago to build and supply electrical motor equipments to carriage builders is to mark a really important point of departure in the new electrical carriage industry. The idea is to supply complete electro-mechanical equipments for the propulsion of vehicles and also to supply launch equipments to boat builders. This company—it is the Fischer Equipment company of 340 Dearborn street, by the way—has developed a complete line of apparatus for the motor, the usual form of steering device, wire-spoke wheels, ball bearings and rubber tires.

The battery cells and trays are shown in Fig 2. This type of battery is manufactured especially for the Fischer company by Sipe & Sigler of Cleveland, O., the manufacturers of the Willard storage battery. The Cleveland firm has just closed a contract, extending over a period of three years, with the Fischer Equipment company for Willard storage cells amounting, it is said, to no less than $238,000. The battery is claimed to be as light as possible

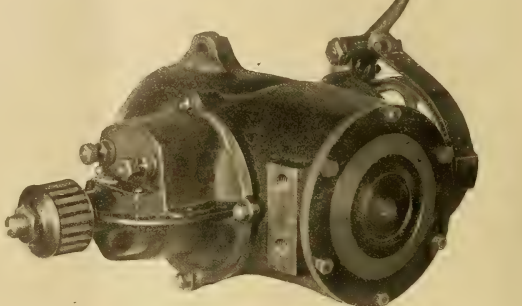


FIG. 3. NEW ELECTRICAL EQUIPMENT FOR VEHICLES.—MOTOR AND BRAKE.

work, and offers it to the carriage builders of the country, who can apply it to any suitable class of vehicle of their own design and finish. The Fischer company does not build electric carriages, but proposes to pilot any carriage manufacturer "into a successful issue with the electrically self-propelled vehicle." The idea seems to be a good one, and the company has thoroughly protected its special devices by patents. One electric trap or drag equipped with the Fischer company's apparatus has been in operation for some time. It was built by the Kimball Carriage Manufacturing company for Mr. Samuel Insull, the president of the Chicago

and to be practical and reliable. The cells are all incased individually in hard rubber shells, sealed at the top, so that they are clean and easily handled. For vehicle work each complement of cells is mounted in four trays, each trayful being connected up ready for use. The entire mechanical construction is designed expressly for transportation work, as is also the output and rating thereof, which are fully guaranteed. All parts of the battery are separated into interchangeable sections. The life of the battery is insured for four years for a percentage of the original cost.

In Fig. 3 is illustrated the commutator side of the

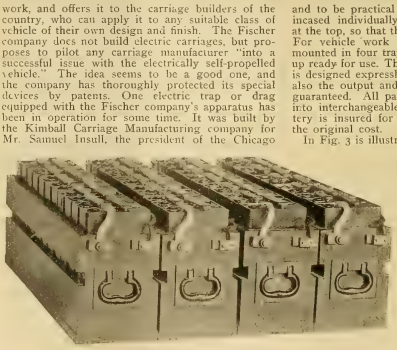


FIG. 2. NEW ELECTRICAL EQUIPMENT FOR VEHICLES. STORAGE BATTERIES.

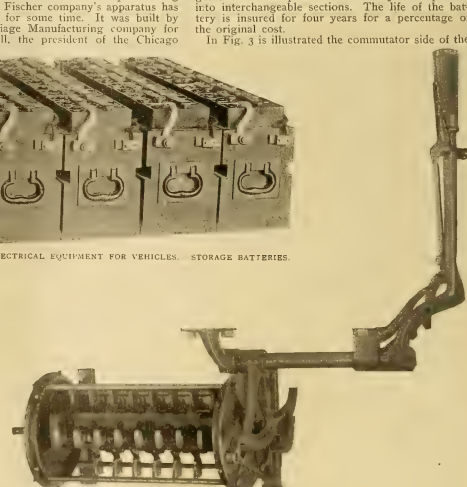


FIG. 4 NEW ELECTRICAL EQUIPMENT FOR VEHICLES CONTROLLER AND BRAKE HANDLE

Edison company. As shown in Fig. 1, this smart vehicle can carry four persons and is decidedly attractive in appearance. The mechanical operation may be judged by a general description of the type of apparatus employed.

The equipments offered by the Fischer company have been developed by C. E. Woods, an electrician who has spent much thought and labor on the problem of electric vehicle propulsion. He uses a special low-speed motor, storage cells of a special type and specially devised wireless controller, reversing switch, braking apparatus incorporated with the motor, the hand brake being shown at the right. This brake is practically a part of the motor and is operated by the same lever that operates the controller, making it impossible to apply the brake without first cutting current from the motor or to turn the current on without first releasing the brake. The motors are said to be the lightest on the market in proportion to capacity. They are completely enclosed and designed to run in any position necessary to attach them to boat or vehicle, the journal being so constructed as to keep the oil reservoir on the underside in any position.

They have self-oiling bearings, except when ball-bearings are demanded. The frames are of steel. The armature is of the iron-clad type, wound with removable coil windings. The journal heads and sockets are made from a special aluminum casting on such sizes as are used for vehicles and launches, which gives great strength and lightness combined, while the journal bearing itself is of brass. Either field-coil or armature can be removed without disturbing body of motor, by taking out bolts on each head, and the removable cover over the commutator permits of instant access to the brushes, which consist of only two sets. It is claimed that after three hours' run at maximum load the temperature of the motor will not rise more than 80° above that of the surrounding atmosphere. Two motors, as in Fig. 1, are recommended for the Fischer equipments, although a single-motor equipment can be supplied.

A side view of the controller and brake handle is given in Fig 4. This ingenious combination device

ARMORITE TROLLEY POLES.

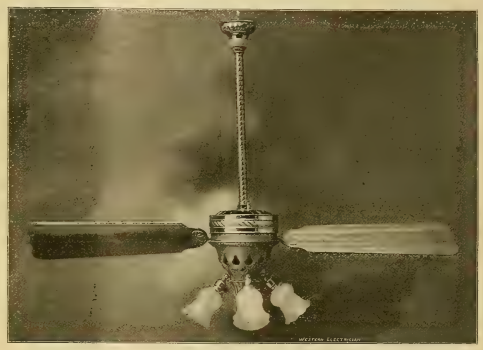
is used to start or stop the vehicle or to operate it at any of three speeds. No resistance is used, the batteries being grouped in series or parallel to obtain the electromotive force desired to vary the speed. It is noteworthy that in this controller there is not a single wire or screw connection of any kind used in the switching or moving parts; neither is there a brush contact of any kind. Knife-switch contacts are used, which clean themselves from corrosion or dirt, and so insure a uniform contact throughout the instrument, which is necessary when batteries are working in parallel. The circuit is instantaneously broken at eight different points, reducing the arcing to a minimum. The contacts are all of a carrying capacity equal to twice their rated value. The controller may be placed either under the seat or under the bottom of the vehicle. The controller and brake handle may be placed either on the right or left-hand side of the vehicle. The reversing switch is similar to the controller in construction.

The motors are arranged for single reduction, the pinion on the armature shaft meshing into a gear-wheel on the hub of each rear driving wheel. These equipments will climb a 10 per cent. grade with full load, it is said. For steep hill climbing a double-reduction gear is supplied. The batteries have a capacity of 30 miles' continuous run at three, six or 12 miles an hour.

The officers of the Fischer Equipment company are: President, S. M. Fischer; vice-president and general manager, C. E. Woods; secretary and treasurer, O. J. Friedman. Mr. Fischer, the president, has extensive business interests. He is president of the Wisconsin and Michigan Railroad company and also of Street's Western Stable Car Line and is interested in several other business enterprises. Mr. Friedman is a well-known Chicago business man.

Hunter Ceiling Fan.

The illustration shows the new direct-current ceiling fan of the Hunter Fan and Motor company of



HUNTER CEILING FAN.

Fulton, N. Y. The general excellence of this company's apparatus is well known. The motor has a short magnetic circuit, with powerful soft-steel fields and a toothed armature. The two bearings are submerged in oil and are spread far apart to prevent the armature from rubbing against the pole-pieces, as is often the case with a short single bearing after a little wear. The blades have a sweep of five feet, and at 192 revolutions per minute the motor is said to take less than one ampere. This small consumption of current is one of the noteworthy advantages of the apparatus. A two-speed switch is placed at the bottom of the fan. As shown in the picture, the fan can also be made to serve as an electrolier.

Armorite Trolley Poles.

Ever since the Armorite Interior Conduit company moved its plant to Pittsburg to obtain the greater facilities for the production of Armorite that were made necessary by the rapidly growing demand for that conduit, the company has forged ahead in a manner which must be very gratifying to those interested in it.

Recently the Armorite company brought out a specialty in the way of a wood-lined tubing for use in chemical works, salt mines and other places where a lined tubing is necessary. The production of this specialty has become a branch of the company's business.

But a more important departure in the line of Armorite manufacture is that of supplying poles for street railways. The accompanying cut gives an idea of one of the styles of poles that the Armorite Interior Conduit company is now manufacturing. Of course this is but one pattern, and blue prints can be furnished showing the variety of poles that the company is prepared to ship.

The Armorite Interior Conduit company produces these poles directly from its own tube works. In other words, purchasers secure them at "first hand" and directly from Pittsburg.

Rapid Drilling Machine for Manufacturers.

In the accompanying illustrations are shown a front view (Fig. 1) and a rear view (Fig. 2) of the manufacturers' rapid drilling machine made by the Pratt & Whitney company of Hartford, Conn. This machine has been designed to do very heavy drilling in steel bicycle-crank brackets, hubs, etc. The connection between the two rack pinion bearings and the table is such as to prevent the drill springing from the work. The oil pan surrounding the table permits the use of a large stream of oil to cool the drill and the work. The table has a vertical adjustment by means of a large screw, central with the spindle. The spindle is counterbalanced, has automatic feed and stop motion, and quick hand movement. It is driven by a large spur gear which

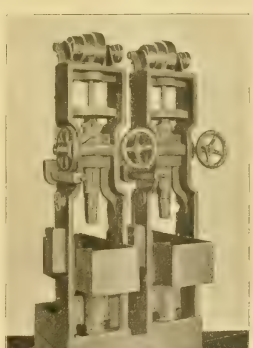


Fig. 1

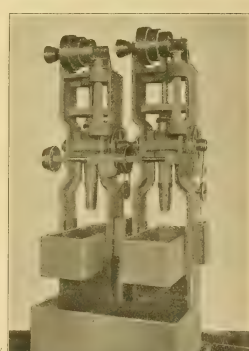


Fig. 2

RAPID DRILLING MACHINE FOR MANUFACTURERS.

slides on a long steel pinion driven through miter gears by the cone pulley. This is a better construction than the usual one in which the spindle is driven by a key over which it slides. The drill thrust is taken on a ball bearing containing three-fourths-inch balls. There are two feed racks on the spindle sleeve, one at the front, the other at the rear; they prevent the spindle springing to one side under a heavy pressure. The two rack pinions are geared together at the side of the frame and are driven by a large worm gear. The base can be made to take from one to four frames.

The machine will drill holes in diameter up to three inches; the number of Morse standard taper holes in the spindle is five. The dimensions of the table are 10 by 14 inches; vertical adjustment of table, 10 inches; greatest distance from end of spindle to table, 24 inches; feed movement of spindle, nine inches; diameter of spindle, 2¼ inches; number of grades on cone, 3; diameter of largest grade, 11¾ inches; width of belt, three inches; gear reduction from cone to spindle, 6 to 1.

The reputation of the Pratt & Whitney company for the production of high-class machine tools is international, and it is to be expected that this new drilling machine will form no exception to the characteristics of its output. The Chicago office of the company is at 42 and 44 South Clinton street. Mr. Charles E. Davis is the manager. The new machine is now on exhibition at that office.

Efficiency Tests on the Englewood and Chicago Electric Storage-battery Road.

[*Continued from page 79.*]

It is to be regretted that a profile of the road cannot accompany this report. The road, however, is practically level. The results of the last table would seem to indicate that in general the grade rose from the power house toward the two terminals.

The efficiency of the battery is shown as follows:

Kilowatt-hours, first charge..................36.757
Kilowatt-hours, discharge.....................19.715
Kilowatt-hours, second charge.................31.631

Efficiency, $\frac{\text{Discharge}}{\text{first charge}}$ .... 53.6 per cent.

Efficiency, $\frac{\text{Discharge}}{\text{second charge}}$ ....62.32 "

Efficiency average, 57.96 per cent.

The graphical log of the two charges is shown in Figs. 4 and 5, and it will be seen that they differ considerably. This is due to the fact that the charging of the battery was left to the regular operators of the plant, who used their judgment both as to the voltage and as to the time the battery should charge at each voltage. They also determined when the battery was fully charged. In the first charge there is no doubt but that the final voltage was too high, and in the second charge it would seem that the battery was charged too long, both of which conditions reduced the efficiency obtained. The result, however, shows the efficiency in actual service, but does not represent the possibilities of the battery.

The amount of the first charge was, of course, influenced by the immediate previous history of the battery, and for this reason the efficiency obtained by using the second charge as a basis is the more reliable. This test showed that the car used 1.41 kilowatt-hours per car-mile, as measured at the charging table, and .87 kilowatt-hour per car-mile was delivered from the batteries to the motor on the car.

IV. Acceleration Tests.

In the tests made upon a car in actual service no opportunity was afforded for accurate acceleration tests. These were made November 13, 1897, upon a straignt stretch of track along Vincennes road, extending south from the power house. In these tests the same instruments and observers as on the other car test were used, and readings were taken in much the same way, with the exception that in this test the observations were made at tne time of passing from one point to another of the controller. After the fifth point was reached the readings were taken at five second intervals. The time between points was obtained by means of a stop watch, and no effort was made to change the motorman's method of procedure in bringing the car up to speed. The average results of five trials are shown graphically in the curve, Fig. 7, which shows clearly the power delivered by the batteries at the different points of the controller and the energy required to accelerate the car.

The current curve shows a maximum of 320 amperes. It will be noticed, however, that at this time all four sets of batteries were in parallel, so that this total of 320 amperes indicates a total discharge rate of each cell of but 80 amperes. The dotted curve below the current curve indicates the actual discharge rate of the individual cell. At the fourth notch it coincides with the total current curve, and at this point indicates the highest discharge rate, which is seen to be 220 amperes, and this rapidly decreases until it reaches 100 amperes, which may be taken as a fair value of the current with the car in full motion. It is to be understood, of course, that the practice of coasting, in which the current is shut off, makes it impossible to obtain the power required per mile from this curve.

In conclusion it may be said that the foregoing tests do not demonstrate the best results that may be expected of accumulator traction, and were not made for that purpose. No excuse is to be offered for the fact that the road was not operating under ideal conditions while being tested, as the primary object of the test was to determine where improvements could be made. If this is kept in mind when comparing the results with those obtained upon the trolley systems of about the same size, it will be seen that the cost of fuel for accumulator traction of something less than one cent per car-mile, is very favorable to storage-battery traction. The improvements suggested by the test are now being made. The overhauling of the engines, the repair of the economizer flue and the securing of a better coal than was used on the test at a cheaper price, should bring the fuel cost per car-mile well within one-half cent. Figures upon the labor and maintenance factors in the cost per car-mile would be of interest in this connection, but are not covered by the figures of the test. The labor account will no doubt be as small as that of any nine-car road, while figures upon maintenance would be premature at this time. The batteries have operated from eight to fourteen thousand miles and are standing the service remarkably well, so that the maintenance account, up to the present, has been comparatively small.

Suspension of Railway Motors.

Following is the text of the decision of the United States Circuit Court in the case of the Sprague Electric Railway and Motor company against the Union Railway company and others upon the patent covering the suspension of motors upon street cars. The opinion was prepared by Justice Wheeler:

This suit is brought upon patent No. 324,892, dated August 25, 1885, and granted to Frank J. Sprague for an electric-railway motor consisting of a field-magnet journaled on the axle of the driving wheels at one end, and hung upon a spring from the truck or the car body, at the other, and carrying the armature shaft upon its pole-pieces parallel with the shaft of the driving wheels, and connected to them by gearing. The specification as to this arrangement says:

> The armature being carried rigidly by the field-magnet, these two parts must always maintain precisely the same relative position under every vertical or lateral movement of the wheels or of the car body; and as the field-magnet which carries the armature is itself centered by the axle of the wheels to which the armature shaft is geared, the engaging gears also must always maintain precisely the same relative position. At the same time the connection of the entire motor with the truck is through springs, so that its position is not affected by the movements of the truck on its springs.

The claims in question are:

> 2. The combination of a wheeled vehicle and an electro-dynamic motor mounted upon and propelling the same, the field-magnet of said motor being sleeved upon an axle of the vehicle at one end, and supported by flexible connections from the body of the vehicle at the other end, substantially as set forth.
>
> 6. The combination with a wheeled vehicle, supported upon its axles by springs, of an electro-dynamic motor flexibly supported from such vehicle, and centered upon the driving axle thereof, substantially as set forth.
>
> 9. The combination with a wheeled vehicle, of an electro-dynamic motor centered upon the driving axle thereof at one end, a spring support for that end of the motor from the truck or body of the vehicle, and relieving axle wholly or partly of dead weight, and a spring support for the other end of motor from the truck or body of vehicle, substantially as set forth.

This patent was before the Circuit Court of Appeals for the Eighth Circuit in Adams Electric Railway company versus Lindell Railway company, 77 Fed. Rep. 432, which was brought upon patent No. 300,827, dated June 24, 1884, and granted to A. Wellington Adams for improvements in electric motors, against structures made according to this patent as infringements. The position of Sprague's invention with reference to prior structures, inventions and patents is there well and comprehensively set forth by Judge Sanborn in the opinion of the court; and the decree dismissing the bill appears to have been affirmed because, in short, Sprague's invention was independent of Adams'. And if Sprague's patent was for merely hanging and centering one end of the motor of a carriage upon the axle of the driving wheels, and suspending the other by a spring from the body of the vehicle, or the truck, it would be shown from that case to be wholly lacking in novelty and void. He was not a pioneer here, and could have a valid patent for only what was new in his method of making the power of the electrical current turn the driving wheel. No one had before however, hung a field-magnet at one end upon the axle of the driving wheels, and at the other upon a spring from the body of the car, or the truck, and an armature axle upon the pole-pieces of the magnet, parallel with and geared to the axle of the driving wheels for driving a car by a current of electricity. This combination simplified greatly the required structures, improved their results, and came into immediate use. The invention of it seems to well support these claims of the patent.

The defendant's structures differ in some respects from those of the patent, but have all these parts working together in the same relation to each other for the same purpose, and producing the same result. They are altered by the addition of a joint in the motor, and of another spring to help carry it, but not by dispensing with any of the parts; they are improved upon but not departed from. The defendants' improvements are not made independent of and clear from Sprague's, but upon his; and his patent appears to be infringed by this taking of his invention to improve upon.

Decree for plaintiff.

Chicago Alley "L" Affairs.

Stockholders of the South Side Elevated Railroad company held their annual meeting January 27th. The election of directors and officers resulted as follows: President, Leslie Carter; vice-president, William Fleming; general manager, Marcellus Hopkins; secretary, John H. Glade; directors, George D. Boulton, T. J. Lefens, A. O. Slaughter, A. A. Carpenter, Byron L. Smith, William B. Walker, Joseph Leiter, C. J. Blair, Ebenezer Buckingham, William Fleming, Leslie Carter.

The net earnings for the 11 months ended December 31st were $121,943.19, or 1.18 per cent. on the capital of $10,323,800.

President Carter made a statement to shareholders in which he said: "The protective committee which had in charge the interests of the bondholders decided it would be best for the property to change its motive power from steam to electricity. We have not gotten on quite so rapidly as we expected in making the conversion, but have done the best we could. The track and equipment are completed, and the power house finished. One engine is installed, and three more will soon be placed. Out of the 120 coaches which are to be converted into motor coaches 75 have already been so converted, and the remainder are being changed at the rate of 10 per week. We adopted the Sprague system after two satisfactory tests, one at Schenectady, N. Y., and another on the Metropolitan elevated, where a train of five cars was very successfully operated for two months. Aside from the advantages of quickened acceleration, easiness on curves, and saving of time in switching, we believe the system will consume less current than other methods.

"The early part of 1897 was a poor period with us. Until October 18th we suffered decreases in traffic, largely due to the opening of the Wentworth avenue and Indiana avenue electric lines by the Chicago City Railway company."

On October 18th the use of the loop began, and from that time to the close of the year the daily average passengers carried was increased from 31,578 to 54,121. President Carter said that the cost of operating on the loop with steam had been unusually heavy, but inasmuch as the company had liberally advertised that its trains would operate over the loop and had gained thereby a large increase in traffic, it was thought good business to hold the patrons thus secured by giving improved service with steam until such time as electricity could be substituted. In the meantime the number of passenger coaches had been increased from 90 to 145. The number of car-miles run per month has increased from 320,000 to 500,000.

American Institute of Electrical Engineers.

The 121st meeting of the Institute, which was held at 12 West Thirty-first street, New York, on January 26th, was devoted to the discussion of the question of standardizing generators, motors and transformers. The discussion was opened by Mr. E. W. Rice, Jr., and was participated in by Messrs. Lozier, Kennelly, Wolcott, Hutchinson, Lieb, Dunn, Coho, Pattison, Henshaw, Steinmetz, Mailloux, Osterberg and Mosscrop. The appointment of a committee to consider the question was suggested and, subsequently, the whole matter was referred to the council for such action as it may deem proper.

At the meeting of the council in the afternoon the following-named associate members were elected: Charles R. Bangs, New York; M. C. Beebe, Madison, Wis.; Hugh Thomas Brown, Selma, Ala.; Edward P. Burch, Minneapolis, Minn.; Eben Clinch Crocker, Bridgeport, Conn.; Albert B. Elias, Thomas, W. Va.; Alexander Stanley Garfield, Paris, France; Chauncey Graham Hellick, Chicago, Ill.; Jacque L. Morgan, Kansas City, Mo.; Herman A. Prosser, Baltimore, Md.; John Joseph Swann, New York; C. Walton Swoope, Philadelphia, Pa.; Jin Tachihara, Schenectady, N. Y.

Tribute to Major Butterworth.

Patent attorneys and all who had business with the Patent Office at Washington entertained warm regard for the late Major Butterworth, and they will doubtless coincide with the views expressed by the acting commissioner, A. P. Greely, in the official announcement of the death of the late commissioner:

> We remember him as a kind, courteous, just and efficient officer—more as an affable, genial, and generous friend and companion than as a chief—an official who commanded the love and respect of all who came in contact with him.
>
> Major Butterworth's successful administration of the Patent Office from November 1, 1883, to March 23, 1885, is well remembered by those who had business with the office during that period, and the news of his selection by President McKinley to fill his old place of commissioner of patents was received with pleasure and satisfaction by all. His re-entrance into the office on April 13, 1897, was received with great satisfaction not only by the officials and employes of the office, but by the attorneys practicing before it. During his brief second term as commissioner he made many wholesome changes in the method of practice and had planned to put the office on a better basis and hoped by honest endeavors to broaden its scope and increase its usefulness.
>
> To honor the memory of our departed chief and friend, the employes of the Patent Office gathered together on the afternoon of the 17th inst., when suitable resolutions were adopted and brief remarks were made expressing the grief felt at his death and the loss to the office. A committee of employes of the office was appointed to decorate the church in which the funeral services were held.

New Cincinnati Edison Station.

Plans and specifications are now being issued for the building for the new generating plant of the Cincinnati Edison Electric company (of which John I. Beggs is general manager), at Plum and Charles streets, in that city. The structure will be 250 feet long and 100 feet wide. It will be built of brick and steel and is designed to be entirely fireproof. It will be divided into two sections by a longitudinal wall of masonry. The engine-room side will be one story high, while in the boiler-room division there will be two stories, the upper one being used for coal bunkers. Each side of the building will have a truss roof. The stack will be of iron, 16 feet in diameter and 200 feet high. The architects for the building are Elzner & Anderson of Cincinnati, and it is expected that the station will be finished by the end of July.

Nearly all the contracts for the machinery have been awarded. The initial equipment of engines will consist of four, supplied by the E. P. Allis company of Milwaukee. One will be of 600 horse power and three of 1,200 horse power each. All will be of the vertical, cross-compound, condensing type. The boilers (water-tube) come from William Sellers & Co. of Edgemoor, Del. There are six of them, of about 700 horse power each, some equipped with chain grates and the others with Hawley down-draft furnaces. The Southwark Foundry and Machine company of Philadelphia furnishes one Weiss condenser of 8,000 horse power capacity. This condenser is of a new design, brought out in Germany. A Green economizer of suitable size has been contracted for as part of the equipment. The dynamos for the direct-current Edison three-wire services are building by the General Electric company. Six machines, each of 200 kilowatts capacity, will be installed at present. They will be directly connected to the three larger engines and arrangement is made for extension by adding other generators as needed. Brush arc machines will be installed for the high-tension series circuits. The station is laid out for a capacity of 6,000 arc lights, but only a portion of the generating plant will be erected this year. The arc dynamos will be belt-driven from a shaft to which all the engines are connected. Bids are now being received for the switchboard and cooling towers. Sargent & Lundy of Chicago are the designing and consulting engineers.

Municipal Socialism.[1]

By Fred De Land.

Part I.

The mayor of Des Moines, a city having a population of 75,000, is the Hon. John MacVicar, who was recently elected president of the League of American Municipalities at the Columbus convention. Mr. MacVicar may yet play an important part in the political history of Iowa, for he possesses many of the attributes of the successful political leader, is a firm believer in the value of organized personal supervision in all campaign work and is ambitious to be re-elected the coming spring, not only because a second term may serve as a stepping stone to higher political honors, but because re-election would be a practical indorsement of his radical views that absolute power rests in the municipality to dictate at what rates and on what terms it may be served by corporations operating under a local franchise.

Naturally, the public-service corporations do not approve of such views, and are not in sympathy with his aims and his desires. But if he deals honestly with the taxpayer and does not degenerate into the demagogue; if he patiently and thoroughly analyzes the reasons that prompt his adherents to demand that certain changes in municipal expenditures be brought about, and then bases final action only on the facts as they are authoritatively recorded, his actions and his utterances may modify the plans of many an electric light, gas and street-railway manager in other cities. For there is little doubt that Mr. MacVicar is ambitious to play a more important part in the coming delusion of municipal socialism than Mr. Pingree ever dreamed of.

But to succeed he must be absolutely honest with himself as well as with the taxpayer. For in every city the heart of the voting element, like the heart of a woman, resembles a lithographer's stone—political destruction alone can efface what may have been written thereon in a moment of executive action. How is it possible for a man to deal honestly with the desires of his own heart when his mind is saturated with the pernicious and fallacious doctrines promulgated by the enthusiasts of the Arena-Parsons type, who believe that large semi-public service-supply corporations can easily be driven forth from a city and from a state whenever a few reformers so decide, unless the corporation submits to the whimsical demands of selfish dreamers. Mr. MacVicar may not know that one state and more than one hundred different cities have tried the experiment and that their citizens now mourn the loss of nearly every dollar invested in the game. Neither may he know that the leading property owners and manufacturers in a larger city than Des Moines are now bewailing the day that they subscribed to the delusive doctrines of a man who has saddled the city with a load that a decade of prosperous years cannot remove—a load that serves as a signboard to warn away investors.

So popular is Mr. MacVicar with a certain class of municipal socialists that his friends are questioning whether he, too, will cater to that unreasoning sentiment that impels the unthinking to blindly follow these self-elected reformers who rail at existing conditions and demand a change for partisan reasons only. Or does he already realize how capricious are the changing fancies of superficial and selfish reformers, and how unstable such support has usually proven to the politically ambitious? Enthusiastic as the advocates of municipal ownership may be in promoting the aims of an ambitious leader, let the thought once be impressed on their minds that the logical outcome of municipal socialism as practiced thus far has been personal inconvenience or personal financial loss to nearly every property holder or manufacturer in the city, either in direct taxation or in lessened values or in loss of profitable trade, and all enthusiasm will vanish.

Some of Mr. MacVicar's warmest friends already perceive how injuriously the city's commercial growth may be affected if word goes forth to capitalists that industrial corporations supplying semi-public service in Des Moines are not considered entitled to the legitimate returns that the public is always willing to grant investments in hazardous enterprises, even such returns as are properly referred to as "the manufacturer's profit." And these friends perceive how detrimental may be the reaction in sentiment when capitalists comprehend the true inwardness of the mayor's recent action in issuing an edict that the sum of $6.25 per month or $75 per year only shall hereafter be paid for each arc light of 2,000 candle power burning all night and every night in illuminating the streets of Des Moines, and that three-fourths of a cent per hour shall be paid for each 16 candle power lamp supplied for the use of the city.

For these friends know that the mayor was well aware that the average cost of producing an arc light in the largest and best municipal plants in the country was $85, not taking into question the matter of legitimate profits that naturally belong to a private corporation, or even certain local charges that a commercial company must always pay. Yet he deliberately set his seal of approval on an edict that virtually informs capitalists that rather than pay a reasonable profit to industrial corporations the citizens of Des Moines prefer either to deal unjustly where the capital is so invested that the company has no alternative but to accept the unreasonable offer, or else the citizens will lock up more than $100,000 in an experimental enterprise—that will prove an effectual barrier to the healthy growth of individual enterprises of like character.

The facts in the premises are as follows: For several years the city of Des Moines had paid the sum of $126 yearly for each arc lamp of 2,000 candle power used in street illumination. Soon after his election Mr. MacVicar started a movement to secure a more favorable contract for the city, and, to strengthen his claim for a reduction in rates, secured from various sources official data regarding prices paid by other cities for street illumination, and what the actual cost is where municipalities own and operate the lighting plant.

As there are three local lighting plants in Des Moines, several conferences were then held with a view to the city purchasing one of the three; but a prohibitory price having been placed on the property, negotiations ended and the mayor began to look elsewhere. Then the engineering firm of McCaskey & Holcomb made a proposition to build, and within six months from date the contract was signed for an acceptable modern lighting plant for a sum representing about two-thirds the actual cash investment in a local plant of similar capacity, as follows:

To build a lighting plant complete for supplying 500 arc lamps of 2,000 candle power and 1,000 incandescent lamps of 16 candle power, for the sum of $105,385; the city to furnish a suitable lot on which to erect the station; payment to be made as follows: $60,385 on completion of the plant; $25,000 one year after completion and $20,000 two years after completion, the engineering company to retain full possession of the plant until the final payment is made, and also to receive from the city the annual sum of $32,500, in equal monthly installments, for the period of two years, to compensate the engineering company for supplying 500 arc lights for all-night and every-night street illumination; this being at an average cost to the city per arc light of $65. The city also to carry during those two years not less than $20,000 of fire insurance on the station, and not less than $50,000 of tornado insurance on the entire plant.

The question of municipal ownership being submitted to the voters, at a special election, it was carried by a majority of 2,416 in a total vote of 5,176, and the proposition above outlined was accepted and the mayor authorized to sign and deliver the contract. At the previous regular election the total number of votes cast was 13,000, showing that less than one-half the usual number of voters felt sufficiently interested to cast a vote.

As the mayor was signing the contract a taxpayer endeavored to prevent his action, but being defeated, he then petitioned the courts for an injunction restraining the city from carrying out its contract. On January 17th Judge Bishop held the contract "to be invalid because it is different from that called for in the specifications and the published call for proposals."

But when the contract for lighting the streets at the old rate of $126 expired, the mayor issued an edict, based on the authority conferred in an ancient ordinance, that henceforth the city of Des Moines would only pay $75 per year for each arc lamp of 2,000 candle power used all night and every night for street illumination.

Admitting that $75 is a higher rate than the $65 which the engineering firm offers to supply the lights for, let us endeavor to ascertain whether the mayor was justified by the official records at his command in so arbitrarily fixing on $75 as a rate which the local lighting companies must accept.

The proposed cost of arc lighting in Des Moines, when the municipal plant is in operation, will be:

Contractor's charge, per arc lamp...........	$65.00
Insurance on plant, per arc lamp............	1.00
Sinking fund or depreciation, at five per cent., per arc lamp...........................	10.00
Total cost	$76.00

The last official report of the cost of street lighting in Detroit shows that the annual cost to the city of Detroit for each arc light of 2,000 candle power, burning all night and every night, was $89.42, while operating 1,600 arc lights out of a possible 2,000, the remaining 400 being held in reserve. This cost of $89.42 was the total of five items: Labor, $43.57; material, $20.62; depreciation, $1.85; interest, $18.28; taxes, $5.10. Depreciation is largely accounted for by maintaining the entire equipment in the best possible condition. But where complete replacement must ultimately follow, a depreciation charge of only four per cent. on first cost is entered. The total investment in Detroit is $714,843.76; a four per cent. interest charge on this equals $28,593.75; the assessed valuation is $427,500, calling for a charge of $7,981.43 for taxes.

The municipal plant in Allegheny City has been in service for several years and operates 1,100 arc lights of 2,000 candle power and nearly 9,000 16 candle power incandescent lamps. The cost per arc lamp per year is $74.32, divided as follows: Operating expenses, $53.55; interest charges at four per cent., $10.73; depreciation charges at three per cent., $8.04; taxes lost by city, $2. The cost of the arc plant was $259,258.43; of the arc and incandescent plants, $348,921, the city supplying the land. Included in the operating expenses per lamp, per year, were: Lamp trimming, $8; inspectors, $2; insurance, $1; coal, at $1 per ton, $10; supplies, $4.20; repairs to arc equipment, $5.50; office and miscellaneous, 30 cents; repairs outside, $5; labor at station, $7.50; salaries at office, $3.25; carbons, $5; total, $51.75.

Mr. Hunter, the gentleman in charge of the Allegheny plant, has publicly stated that, in his opinion, a fair price for commercial companies having overhead construction to charge for street lighting, where arc lamps of 2,000 candle power were in service for 4 000 hours, is $80 per year, where good coal costs $1 per ton; if coal costs $2 per ton, $90; and $100 if coal costs $3 per ton. If the circuits in the down-town district are underground, an increased ratio should be allowed to cover the interest on the increased investment necessary.

The facts regarding the Topeka municipal plant were officially reported in 1896 as follows: "The plant consists of a lot and building by a railroad switch, three boilers and three engines (worked to 235 horse power), six 30-light Jenney Indianapolis arc dynamos, six circuits with 24.72 miles of line and 33.5 miles of wire, supported on 943 30-foot poles, and 184 lamps of 2,000 candle power each, placed 1,100 feet apart one way and 800 feet the other. A test of 17 lamps showed an average pressure of 23.15 volts, and a current of 19 amperes equals 439.85 watts, or 1,953 nominal candle power. The lot and building cost $8,559.33; the plant, poles and wire, $46,888.65; total cost, $55,447.98."

In May, 1896, after less than seven years' service, the old machinery in the Topeka plant was condemned as wasteful, unsuitable and unserviceable, and was finally exchanged for modern apparatus at an additional cost of $13,772. And in making this exchange only $1,500 in trade was allowed for the old apparatus, which means a depreciation exceeding 10 per cent. per year.

The officially reported total "cost of operating the Topeka electric light plant," from November, 1889, to December, 1892, inclusive, was $54,240.95, or an average cost per arc lamp per month for 38 months of $7.75. The operating expenses are thus itemized, it being stated that "the best lump coal has been used, at an average cost of $2.75 per ton." Coal, $13,924.64; carbons, $2,981.31; globes, $235.80; oil and waste, $642.70; repairs, $4,847.57; insurance, telephone, etc., $1,329.96; pay-roll, $19,743.85; interest at six per cent., $10,535.12. The total cost to May 31, 1896, is $85,700.

In other words, Topeka paid during the first six years of municipal ownership, when machinery, circuits and lamps were new and in good condition, and cost of maintenance low, $93 per year for each arc light used in street lighting, not taking into consideration the extra investment necessary to replace old machinery, or the risk that attends all enterprises of like character, plus the loss of water rates, taxes, etc., which a private corporation would

1. Northwestern Electrical association, Milwaukee, Wis., January 26, 1898.

have paid. Moreover, there is $70,000 of the taxpayers' money locked up forever.

To recapitulate: The cost per lamp per year in the three most promising plants cited is shown to be officially reported as follows:

Detroit, Michigan	$89.42
Topeka, Kansas (moonlight schedule)	93.00
Allegheny City, Pennsylvania	74.32

Or an average cost of $85 per year per arc lamp.

These are figures that every practical and honest engineer would accept as showing the best that has been accomplished under the most favorable local conditions. For the economical administration of the municipal plant in Allegheny has always been worthy of commendation, even by engineers who could not approve of the low allowance for depreciation. And the commission of six citizens under whose wise administration the Detroit municipal plant was placed in operation, and who gave two years' services free of compensation in any form, was guided in all its deliberations by a chairman whose wide experience and practical ability in successfully solving vexed problems arising in large financial undertakings has been amply demonstrated in many ways. And this commission secured the services of a practical electrical engineer of established integrity who had designed, built and operated many electric-lighting plants under conditions differing in each case.

In view of these facts from official reports, and of Mr. Hunter's statement that where good steaming coal costs $1 per ton $80 is a fair price for commercial companies to charge for street lights of 2,000 candle power burning all night and every night, are not thoughtful investors in corporation properties justified in wondering whether this arbitrary action of the mayor in allowing only $75 per arc light supplied by commercial companies was simply a political stroke to gain the applause of unthinking voters? And are capitalists not justified in hesitating to invest a dollar in Des Moines? No state in the Union has a more intelligent population; few states so rich and productive as Iowa. Must all development be arrested for a term of years because a few men would sow the tares of municipal socialism in the hope that, through awakening a hatred of all corporations, they may reap certain political honors?

Discussion.

Mr. DeLand: Mayor MacVicar's official report showed that the cost of lighting in Topeka was only $48 a year, but a proper analysis showed that the actual cost was $93 per lamp, and that, too, without taking into account depreciation which really should be included.

Mr. Livermore: Is it not a fact that the president of the Detroit Municipal Lighting commission made a report, in which he stated that in his opinion he never believed nor had the figures borne out the facts that arc lights could be produced in that city for less than $102 per year? My idea is that this statement was made in a letter signed by the gentleman who, on his own authority, stated that he never personally believed that they could do it for less than $100, and the facts had borne him out.

Mr. Doherty: Two of the engineering clubs at the Wisconsin University had a debate on the advisability of the city of Madison operating its own electric-light plant. The boys on the negative side have tried to compute the depreciation of the plant; they separated the items, as buildings, machinery, etc., and classified them. Then they went to able authorities and secured their opinion on the life of that class of construction and the total depreciation figured up 8.3 per cent. Taking 8.3 per cent. depreciation charge and figuring interest at five per cent., I have made up the figures on the Detroit plant, and I believe they amount to something over $105 per arc lamp. As Mr. Dow has stated, Detroit is very favorably situated for coal and has everything in its favor, yet the cost figures up 59 mills per thousand watts furnished the city. I think if any of us will figure the cost on all night lamps we will find that we are not charging our municipalities as much as it costs the city of Detroit, and when you take the difference in the price of coal into consideration, you will find that the truth, as Mr Dow says, strengthens our hands with our city authorities. We are furnishing the city of Madison with 1,200 candle power lamps at 58 mills per thousand watts, as against 59 [illegible] Detroit, which, when you take into consideration the difference in price of coal, is really a much cheaper rate than is being given in Detroit.

Prof. Jackson: Depreciation is a somewhat complex question, and unless one has looked over one's figures and his books very recently, one is very likely to be somewhat at fault. But I bear this in mind that taking paying plants for the last 20 years and estimating their present value the depreciation is something atrocious—it is heart rending to the owner! On the other hand, if we consider the value on the basis of prices for machinery, etc., paid at that time, we have the proposition: In a town of from 20,000 to 100,000 inhabitants, if you consider buildings put up in the best manner, with all machinery, lines and appliances [illegible] leave out of the question changes [illegible] it is impossible I think, for anybody who has to do with commercial matters to figure that the depreciation is less on the entire plant than 7½ per cent. per year, unless a very large amount of repairs is put into the plant in the way of replacing outside construction and machinery every year; which is not ordinarily expected to be done and is not ordinarily done. I do not believe that the city of Detroit, even with its magnificently constructed plant, with underground conduits and excellent cables laid therein, in which the depreciation undoubtedly is much smaller than in any other class of outside construction, is justified in considering that it will not have to revolutionize the entire plant within 20 or 25 years; that is to say, it would take the most optimistic of men who has any acquaintance with electric lighting, commercial electricity and the improvements already made and those which probably will be made in the future in the manufacture of appliances, to believe that the Detroit plant has a right to expect to find its construction at the end of 20 years such that it has not got to be entirely revolutionized and a new plant put in as a whole. I am absolutely confident that there are no plants in the state of Wisconsin which have a right, under their present constrution, to write off less than 7½ per cent. on their value, and I doubt if there are many that have a right to write off less than between 10 and 15 per cent.

I think central-station men have been going at this question from an entirely wrong side of the house. I feel quite confident that Prof. Bemis and Prof. Parsons, for instance, and others who have agitated this question, intend to tell the truth, but they are making a mistake simply because they do not have a correct commercial training, and the only way to down the troubles that are facing the central-station men on account of this agitation for municipal ownership, is to have such organizations as this and the National Electric Light association, and possibly others, get together and persuade some man of national reputation in financial matters and national reputation for integrity and uprightness and truth, to examine into the accounts not only of the Detroit plant, the Topeka plant and the Allegheny plant, but to go into a number of other smaller plants that Mr. Bemis has reported upon from time to time. To affect the great public the electric-light men have got to get some man of national reputation for independence and integrity and knowledge of commercial matters to make the examination and report, and until that is done you may expect this agitation to continue, and your report, although absolutely correct, turned down.

CORRESPONDENCE.

New York Notes.

New York, February 2.—In the wonder and dismay over the Boston storm the troubles experienced by this town during the last week have been generally overlooked or disregarded. At any other time the damage sustained during the last week by the electrical interests of this section would attract general attention. The absence of overhead wires in the crowded downtown districts made such a disaster as that of Boston an impossibility here anyway. The operation of the underground trolley system is being narrowly watched, as it is recognized that much depends upon its performance this winter. It must be admitted that thus far it has behaved admirably, but of course it has not as yet been subjected to any such severe test as that which the overhead trolley in Boston experienced.

The syndicate which built the Nassau electric trolley lines in Brooklyn has secured control of the rights of the People's Traction company and the Westchester and Connecticut Traction company to build trolley roads east and north of the territory now served by the Union Railway company, and running out to Mount Vernon and New Rochelle. It was declared that the work of building these roads would be begun in May. At a special meeting of the two companies held this week W. A. Boland was elected president of each company, Silas B. Dutcher vice-president, and Fred C. Cocheu secretary and treasurer. Among the directors are John McCarthy, Joseph White and M. J. Kennedy.

P. H. Flynn, who is prominently identified with the enterprise, said yesterday that the companies had franchises to build 40 miles of road. Work, he said, would be begun first upon the line leading out to Mount Vernon on the Boston road.

Attorney-general Hancock has prepared an opinion informing State Comptroller Roberts that there was no manner in which the surface roads could be compelled to give to the Board of Electrical Control of New York city or to the state comptroller information relative to the mileage of undergound conductors operated by such roads. The comptroller submitted communications from Secretary Henry S. Kearney of the Board of Electrical Control and President H. H. Vreeland of the Metropolitan Street Railway company relative to the matter. President Vreeland claimed that his road is not "operating any electrical conductors in the city of New York that come within the purview of the acts of the Legislature establishing boards of commissioners of electrical subways, or that are within the jurisdiction of the Board of Electrical Control in the city of New York." The attorney general, in his opinion, says: "While it was evidently the intention of the Legislature to put companies engaged in the transmission of messages and light, heat and power under the authority of the Board of Electrical Control, it was never the intention of the Legislature to put street surface railway companies under the same control. This is demonstrated by the fact that the affairs of both steam and street surface railways in the state have long had the supervision of the State Railroad Commission, and that this commission has supervision and control of the railroad companies regarding changes of motive power."

The Fort George and Eleventh Avenue Railroad company of New York has filed with the secretary of state at Albany a certificate of incorporation. The company is to operate with power other than steam a road 1,500 feet long on the boulevard, or Eleventh avenue, this city, from Kingsbridge road to One-hundred-and-seventy-fifth street. The capital is $10,000, and the directors are John T. Little, Jr., D. S. Johnstone, Charles R. La Rue, Fred C. Garrick, Thomas Hanlon, Jr., and Harry J. Turner of New York city; C. M. Cumming of Yonkers, J. Howard Brouse of Mount Vernon, and Charles A. Gilbert of White Plains.

Professor F. B. Crocker has accepted the position of consulting engineer of the electrical exhibition in New York. Prof. Crocker regards the exhibition as a highly useful means of reaching the public. His name as consulting engineer is a guaranteee of good work being done under his supervision by the construction staff in the disposition and safeguarding of the exhibits.

An auxiliary and educational committee has been formed to take general charge of exhibition matters other than commercial, and to co-operate with the advisory committee which represents the New York Electrical society. T. C. Martin, who was chairman of the committee of the last show, has again consented to serve in the same capacity. With him are associated Prof. F. B. Crocker of Columbia University, Prof. Morris Loeb of the University of New York, Prof. W. E. Geyer of the Stevens Institute of Technology, Dr. Charles A. Doremus of the College of the City of New York, Herbert Laws Webb, J. B. Taltavall, Dr. Park Benjamin, G. H. Guy, W. T. Wheeler, Lieut. G. O. Squier, U. S. A., and Thomas A. Edison, Jr., who is in charge of some special decorative and mechanical effects.

Mr. Gould, the president of the Manhattan Railway company, has transmitted to the Rapid Transit commission a formal application for the connections, extensions and additional tracks and facilities desired by the company, but there is no mention of electrical operation in the application or the accompanying letter. It is understood that George H. Pegram, chief engineer of the Union Pacific railroad, who resigned recently to take the place of consulting engineer of the Manhattan Railway company of this city, will enter upon his new duties without delay.

On Sunday the Metropolitan Street Railway company began using its underground electric system on the upper section of the Ninth avenue line. For the present the cars are run from Sixty-fifth street through the boulevard to Seventy-second street, and thence through Amsterdam avenue to One-hundred-and-twenty-fifth street. The first cars were sent over the line at 10 a. m. The first two carried no passengers, and were sent ahead to see that the line about to be put in use was in proper condition. As soon as the two returned they were started back with a load of passengers transferred from the Broadway line. During the day eight cars were placed on the line, making regular trips with about 10 minutes headway. The speed of the cars, however, was slow, but the motormen stated that their orders had been to run slowly, and that a rate of 15 miles or more an hour could be easily attained. Transfers were given at One-hundred-and-twenty-fifth street and at Sixty-fifth street to the Ninth avenue horse-cars and the Broadway cable lines. As soon as the double conduits can be laid in Columbus avenue from Sixty-fifth to Fifty-ninth streets the cars will be run through to the East River by way of the Central Park, East and North River railway. The horse-cars in Fifty-ninth street will then be discontinued. President Vreeland states that he expects that by March 1st all cars north of Fifty-ninth street will be operated either by the underground electric system or by cable.

The running of the Amsterdam avenue cars through Fifty-ninth street will give a more rapid connection with the Second, Lexington, Madison, Sixth, Seventh, Eighth, Ninth and Columbus avenue lines of the company. M. S.

PERSONAL.

Clarence E. Stump, well known to street railway and electrical men, has severed his connection with the Electrical World.

Louis A. Ferguson, the general superintendent of the Chicago Edison company, will sail for Europe next week. Mr. Ferguson will be away five weeks and will give his attention to business methods employed in foreign cities, especially in England.

Mr. W. B. Scarf, who is the deputy minister of patents and also deputy minister of agriculture in Canada, is in Washington studying the patent system of the United States. The British ambassador introduced Mr. Scarf at the Patent Office on Thursday of last week.

Mr. Gustav Bissing announces that he has resigned the position of principal examiner in charge of Electrical Division A in the United States Patent

Office, which he has held for a number of years, and has formed with Joseph Lyons a copartnership for the practice of patent law.

Edward B. Ellicott has been appointed city electrician of Chicago under the new ordinance creating a Department of Electricity.

The Technical Club of Chicago has elected the following-named officers for the year: President, Robert W. Hunt; first vice-president, C. F. Quincy; second vice-president, Charles E. Billin; treasurer, James F. Lewis; directors, E. M. Hagar, J. W. Dickinson and James R. Chapman to fill vacancies, and Onward Bates, S. P. Wells, Jr., William Rhodes and L. A. Ferguson for three years.

T. C. Penington, who returned to Chicago on Monday from an eastern trip in the interest of the American Street Railway association, reports the outlook for the annual meeting at Boston, in September, as unusually favorable. An excellent hall in the building which will contain exhibits will add greatly to the comfort and convenience of visitors. Mr. Penington says there will be no question this year about ample floor space, as 65,000 square feet will be at the disposal of exhibitors.

Mr. Samuel Insull, the president of the Chicago Edison company, came home on Friday of last week, returning from a holiday trip to England. Mr. Insull found the outlook for the electrical industry in Great Britain to be good, the prospects of an active development in electric traction for the next few years being especially bright. Lightning, the English electrical journal, reports that Mr. Insull was entertained at a dinner given by several gentlemen interested in electrical undertakings at the Whitehall Club, London, on January 6th. Among those present to do honor to the guest of the evening were Philip Dawson, Sidney Dobson, R. E. Crompton, S. Z. de Ferranti, H. F. Parshall and R. F. Sellon. Mr. Insull described the up-to-date American practice in the central-station business, and gave a brief outline of the system of his own company. Remarks were made by Messrs. Crompton, Ferranti and others. The dinner was entirely informal, and was an exceedingly pleasant one.

ELECTRIC LIGHTING.

The American Loan and Trust company of New York on January 29th procured from Justice Dunwell an order directing the sale of the franchise and property of the Geneva Brush Electric Light and Power company. According to the press dispatches, "continued and united opposition of gas magnates and kerosene-oil dealers worked the destruction of the corporation. Although a city, Geneva will hereafter be lighted by kerosene."

The railway station and terminal yards and tracks of the Chicago, Rock Island and Pacific Railroad company and the Lake Shore and Michigan Southern Railroad company in Chicago are now lighted by current supplied by the Chicago Edison company. The current was formerly supplied from a private plant in the station at Van Buren and Sherman streets, but the engines and dynamos have now been discarded, and the load is carried by the central station. From dusk to daylight 2,000 candle power arc lamps are burned every night in the yard, and there are also from 800 to 1,000 incandescent lights in use. Probably the passenger elevator in the station building will be operated by electricity. At present hydraulic power is employed for the elevator. It is stated that the change from isolated plant to central-station supply was made to secure greater economy.

ELECTRIC RAILWAYS.

A bill has been introduced in the Assembly at Albany to compel street railway companies in cities of the second class to give passengers who are compelled to stand while a car goes five or more blocks tickets entitling them to another ride.

The St. Louis Star is making an effort to secure the benefits of electric traction for the terminal tunnel of that city. It says that as things are at present through there is a tunnel given a "flashlight picture of hell." It cites the example of the Baltimore tunnel, and urges that St Louis profit by the experience.

The Central Railroad company of New Jersey is said to be contemplating a project to connect its terminal in Jersey City with Jersey City Heights and the city proper by means of an elevated electric railroad. There is at present no way by which residents of the Heights or the city can reach the terminal except by going to New York and recrossing the river by the Liberty-street ferry, or else by being towed across a short distance in an odd scow. An old elevated railroad franchise which permits the building of a road from the Jersey Central terminal to the Heights has been secured by men representing the railroad company, and it is the intention of the promoters of the new line, it is reported, to extend the system to Newark, and ultimately to Trenton and Philadelphia. The new line will tap the most populous district of Jersey City, and, at the same time, provide a rapid route to the places it is proposed to take the line.

ELECTRICAL SECURITIES.

The Erie Telephone and Telegraph company has declared a quarterly dividend of one per cent., payable February 15th.

The Madison (Wis.) Gas and Electric company, in its comparative statement for December, shows net earnings of $6,465 against $6,097 for 1896 and $38,423 for the nine months of the fiscal year, as compared with $30,342 for the corresponding period of the year previous.

The Edison Electric Illuminating company of Brooklyn reports gross earnings for 1897 at $875,929, an increase of $65,663 over last year. The operating expenses for the same period were $480,717, an increase of $30,452. Interest and taxes amounted to $91,863, a decrease of $6,137, and the dividends $237,109, an increase of $12,109. The surplus is reported to be $79,327, an increase of $12,179 over that of 1896.

Preferred stockholders of the Pennsylvania Heat, Light and Power company are not satisfied with the proposition of the projectors of the deal to consolidate all the electric light companies of Philadelphia upon a basis of $15,000,000 bonds and $15,000,000 stock, to pay $35 per share of the stock with six per cent. guaranteed, as they claim that they should receive a prior lien bond bearing six per cent. interest for the $35, and then share with the common in the five per cent. bonds offered.

For the last seven months of 1897 the earnings of the Metropolitan street railway of Kansas City, which is controlled by Chicago capital, made a fine showing compared with those of the same months in 1896, as follows: Gross earnings in 1897, $1,171,876, in 1896, $1,082,970; operating expenses in 1897, $632,673, in 1896, 608,300; net earnings in 1897, $539,202, in 1896, $474,669. For the first 23 days of January, it is said, the company's gross earnings were $11,909 greater than for the same period in 1897.

The report of the American District Telegraph company of New York for the year ended December 31st shows gross earnings, $530,342; miscellaneous, $17,786; operating expenses and construction, $472,941; dividends, $76,882; deficit, $1,695; previous surplus, $54,713. The company holds the same stocks and bonds in the treasury as in the previous year, valued at $234,700. The company has 1,448 miles of wire in operation, 83 offices, and 29,553 instruments in operation. There were 2,521,935 messenger calls in the year, 4,307,537 telegrams were delivered, and 8,262,210 circular department deliveries. The cost of construction, maintenance, etc., has decreased 10 per cent., while the company's facilities and service have been kept up to a maximum of efficiency. Four new offices were added to its system, and 10 others, heretofore carried as branch offices, have been individualized.

MISCELLANEOUS.

City Electrician Edward B. Ellicott will give a lecture upon "The Fire-alarm System of Chicago" before the Y. M. C. A. Electrical Club, Friday evening, February 11th. The lecture will be illustrated with working apparatus, which will be in charge of D. M. Hyland. This will be the first of a series of practical talks which will be given before the Electrical Club by prominent electrical engineers.

Apropos of the German occupation of a Chinese port, it is stated that vast untouched beds of sheet mica lie within 50 miles of Kiao-Chow Bay. The extent of the mica deposits is as yet unknown, but they promise to handsomely repay those who are fortunate enough to obtain a franchise for working them. The rolling, sandy hillocks, under which the mica lies, are but poor land for cultivation, and hence their use for mining purposes detracts nothing from the cereal-producing capacity of the region. The mica crops out at intervals over some 50 square miles and in veins sometimes 10 feet thick. Of course much of it is discolored by foreign minerals, but it is believed that there are vast quantities of good commercial material

Acting on the instructions of the French minister of war, a committee of the Académie des Sciences has drawn up a report on the precautions to be taken in fixing electrical conductors in or near powder magazines. The committee makes no distinction between electric light and power conductors and telephone or telegraph wires, since all these may be exposed to lightning. The recommendations can be summarized as follows: All underground conductors for electricity, as well as gas and water pipes, should be kept at least 10 yards from the magazines. Aerial lines should be placed even further away—20 yards is recommended—and should be so arranged that they will not fall across the magazine in case of fracture. If light is required inside the magazine all wires are to be led in strong metal pipes, and then all switches and fuses, etc., controlling the lamps are to be placed outside the magazine. Only fixed lamps are permissible, and then they should be protected by a second envelope of glass. No voltages over 110 may be used. Any electric bells required in the magazines must be placed at least four yards from the powder, and the bells must be such as require very little current.

TRADE NEWS.

The Walker Electric company has taken a contract for building an electric railway in Kansas, starting from Leavenworth.

The Bernstein Electric company of Boston made an assignment on January 20th to General B. F. Peach, Jr., of Boston. It is the intention of the assignee to continue the business and fill orders as promptly as possible.

The St. Louis Car company has purchased the plant of the Union Car company near Baden. The former company, it is said, will remove its entire plant to the Baden property, expend $100,000 or more in improvements and increase the number of employes about 50 per cent.

The General Electric plant at Schenectady, N. Y., it is reported, is running day and night to keep up with the large amount of work on hand. The company's new fiscal year was begun February 1st, with contracts aggregating $14,000,000 and cash in the treasury of $2,500,000, it is said.

Hereafter the New York office of the Housatonic company, in the Postal Telegraph building at 253 Broadway, will be the main sales office of the company, to which all correspondence should be addressed. Friends in New York are invited to call and inspect the company's samples.

Frederick L. Merrill, now of Sipe & Sigler, Cleveland, manufacturers of the Willard storage battery, has been visiting Chicago. Mr. Merrill reports the landing of several fine storage-battery orders. Mr. Merrill recently resigned his position with Sipe & Sigler, and will act as general agent for them. His headquarters will be in Cleveland. Mr. Merrill is one of the most experienced storage-battery salesmen in this country, and he will doubtless do good work for his new connection.

Treasurer and General Manager L. H. Rogers of the Fort Wayne Lamp company of Cleveland is visiting Chicago. Mr. Rogers is much elated over the fact that his representative in Cook County, Martin J. Insull, of Sargent & Lundy, Monadnock block, has fitted up the new magnificent limited train of the Pennsylvania railroad with the Fort Wayne lamp. This will be a splendid advertisement for the Fort Wayne lamp, and the fact that this lamp is being used in the Pennsylvania railroad in its best train will be a decided feather, so to speak, in the company's cap.

Hugo Reisinger has moved his offices to 419-404-405-406, the Bowling Green building on Broadway, New York. These offices are located on the Broadway front, and are elaborately furnished. Mr. Reisinger has entered into contract with the Electra carbon, for which he has the exclusive American agency. The universal desire of users of carbons for arc lamps to secure an efficient service makes it important that the best carbons be secured, as it is a well-known fact that the question of excellence in dynamos and arc lamps counts but little when low-grade carbons are used.

President S. Swarts of the Swarts Metal Refining company of Chicago writes to the Western Electrician to say that the company is in no way connected with the Swarts Iron and Metal company, which recently sold out its business. "We are entirely on different lines," says Mr. Swarts, "and have at no time had any connection with them in any shape. Their name, being somewhat similar to ours, caused some confusion among the trade. We take this means of notifying the trade that we are still doing business at the old stand and are ready to fill any orders that may be entrusted to us."

The Gazetteer company, Cleveland, O., has just issued a directory of power plants in the principal cities and towns of the state of Pennsylvania. This book is gotten up in attractive form, contains a list of power plants in all municipalities with an excess of 5,000 population, together with the names of the manager, superintendent and chief engineer of the companies, and gives detailed information as to the power used, number, style and horse power of engines and boilers, number of pumps, dynamos, elevators, etc. It is also a directory of mechanical and consulting engineers, contractors and supply houses and other information of interest to power users and engineers. The book contains 250 pages, is handsomely bound in cloth and excellently printed.

The Sprague Electric company of New York has secured the contract for motors to be installed in the new works of the John Stephenson company, Industrial Elizabethport, N. J. This is a large and important contract, and some 48 motors will be utilized, ranging from three horse power to 40 horse power, mostly large size machines. The motors will be of the well known Lundell type, and will be direct connected, belted or coupled to the latest types of wood-working machinery. As is generally known, the Lundell motors are of the inclosed type and are admirably adapted for use in wood working machinery establishments where, of necessity, the atmosphere is filled with dust. Several large size Lundell direct connected exhaust fan outfits will also be included in the equipment. The plant will be one of the largest of its kind in the country and will be equipped exclusively with the Lundell motors.

BUSINESS.

Sipe & Sigler, Cleveland, O., manufacturers of the Willard storage battery, have recently filled orders for the Western Union Telegraph company for 120 Willard storage cells for Hoboken, N. J., 40 cells for Scranton, Pa., 30 cells for New Haven, Conn., 25 cells for Newark, N. J., and 343 plates for Ravenna, N. Y.

The '98 calendar of the Wagner Electric Manufacturing company of St. Louis shows the variety of the company's products. Motors, transformers, ventilating fans, switches, switchboards and other forms of apparatus are illustrated—a recent two-page advertisement in the Western Electrician being reproduced with good effect.

W. W. McChesney, Jr., representing Huebel & Manger, has started on his semi-annual trip through the West. Judging from the first few days' experience, the prospects are good for a successful and profitable trip. Reports from all parts of the country are encouraging, and Mr. McChesney believes that this year will be better than any preceding one, and he hopes to book many large orders for his firm before he returns.

There is no better railroad system in the Central states than the Big Four, with its lines extending from St. Louis to Indianapolis, Cincinnati and Cleveland, with through trains to New York; a perfect line, well ballasted and splendidly equipped from Chicago to Cincinnati and Louisville, making direct connections for all points south and southeast. The Big Four and Chesapeake and Ohio railways form the scenic line to Washington.

The New Standard open-circuit dry battery, manufactured by William Roche of 259 Greenwich street, New York, is having a large sale. The fact that Mr. Roche has had many years of experience in this class of manufacture eminently fits him to offer "the New Standard dry battery" as a strong competitor for honors in the electrical field, and his guarantee, which accompanies his product, would seem to satisfy the most exacting, as his claims for uniform strength are very broad.

The swinging tree insulator which is manufactured by the Western Electric company is a device which will be thoroughly appreciated by the central-station manager whose lines pass through trees. This insulator fully protects the lines from swaying branches without cutting the insulation, and is readily hung by a wire twisted through the hole at the top. This loop of wire can be lengthened and adapted to a wide range of conditions. A good time of the year to inspect line wire is just before the trees begin to bud and blossom, for at that time it can easily be seen how near the wires approach the limbs, and there are better opportunities for placing the tree insulator in an advantageous position when the view is thus unobstructed. These insulators can also be used to support arc-light wires when passing under bridges, awnings or iron roofs.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued January 25, 1898.

597,782. Telephonic Installation. Georg Ritter, Stuttgart, Germany. Application filed June 11, 1896. Patented in Germany May 26, 1893, and in England August 4, 1894.

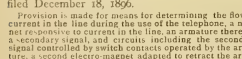
A feature of this invention is a connecting plug for insertion in the test ring, comprising a body of insulating material, contact pieces fixedly arranged upon the handle and insulated from each other, a movable contact ring arranged on the handle, and a spring for normally holding the contact ring in engagement with but one fixed contact piece, the movable ring adapted to be moved by the insertion of the plug in the test ring, so as to effect electrical connection between two of the fixed contact pieces.

597,785. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed April 16, 1895.

The combination with a telephone line, of means for producing a signaling current in the line, and a relay in the circuit responding to such current, a local circuit including a subsidiary line signal controlled by the relay, an auxiliary helix on the relay in the local circuit, means for establishing connection with the line, and switch contacts actuated in the establishment of such connection adapted to interrupt the current through the auxiliary helix.

597,786. Telephone Circuit. Charles E. Scribner, Chicago, Ill. Application filed December 18, 1896.

Claim is made for a source of telephonic undulatory current and a receiving instrument therefor, in a closed conducting circuit, plugs being arranged in the line circuit and operator's telephone set having one side connected with the line circuit, and the test battery having one of its poles connected with an auxiliary circuit and a shunt through the restoring coil of the clearing-out annunciator to certain contact devices of one of the connecting plugs, the test battery having its other pole connected with the operator's telephone set as well as certain contact devices of the connecting plugs through the restoring coil of the individual annunciator in such manner that the connecting plugs when properly manipulated are adapted to establish the connections and automatically raise the indicator of the clearing-out annunciator.



NO. 597,786.

597,787. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago Ill. Application filed December 18, 1896.

Provision is made for means for determining the flow of current in the line during the use of the telephone, a magnet responsive to current in the line, an armature therefor, a secondary signal, and circuits including the secondary signal controlled by switch contacts operated by the armature, a second electro-magnet adapted to retract the armature, a circuit including the second magnet, and circuits closed to excite the magnet in the act of making connection with the line.

597,790. Electric Cable. Willoughby S. Smith and William P. Granville, London, England. Application filed November 1, 1897. Patented in England April 30, 1895.

An electric cable is composed of a tubular case inclosing a cylinder which is built up of two or more segments, and has a longitudinal central hollow air space, and also has one or more wires embedded in each segment.

597,799. Electric Railway. Eben C. Crocker, Bridgeport, Conn. Application filed April 23, 1897.

Two series of magnets are arranged in horizontally disposed couplets, the respective magnets of one series being in circuit with the respective alternate magnets of the other series when the circuits are closed, connections are provided between the terminals of these circuits and the line wire and sections, and suitable switches are operated by the magnets of each couplet for opening and closing the circuits in succession as the car advances.

597,816. Armature-winding Machine. Carl Eickemeyer, Yonkers, N. Y. Application filed October 30, 1897.

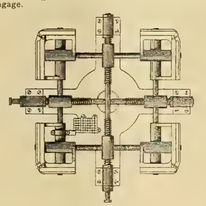
Four coiling plates are rectangularly arranged, and screws are operatively coupled to the plates, and proportioned so that one rotation thereof will move the plates from the position required for a coil of one size to one next larger or smaller, and stops which lock the screws in position after each complete rotation.

597,846. Manufacture of Storage Battery Grids. William W. [illegible], [illegible], Pa. Application filed November 22, [illegible]95.

In a sectional mold there is the combination with one section having a surrounding flange extending beyond its face, of a second section adapted to be received between the flange of the first section, means for moving the second mold section toward and away from the first section, and a receptacle below the plane of the mold communicating with the interior thereof for reception of the superfluous metal.

597,848. Trolley. George A. Hall, Portland, Me. Application filed February 6, 1897.

One claim is given: In a trolley, the combination with the curved roller stock, of the roller having an axle, the ends of which lie flush with the outer surface of the stock, spring plates secured to the stock to overlie the ends of the axle, and lugs with which notches in the ends of the plates engage.



NO. 597,816.

597,855. System of Electrical Distribution. Harvey Linton, Altoona, Pa. Application filed May 7, 1894.

A system of electric distribution is described, comprising a series of separated contacts independent of the track rails and arranged to be engaged by a traveling contact on the car, a main conductor having a branch conductor leading to each contact, a wire leading from the branch to the ground, and a magnet arranged to automatically make and interrupt the circuit through the contact to ground, and thereafter connect the main conductor to the contact.

597,880. Electric Furnace. William S. Horry, Sault Ste. Marie, Mich. Application filed April 16, 1897.

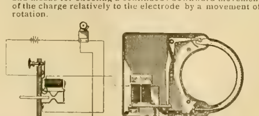
This furnace comprises the combination of a bottomless hopper, electrodes supported on the walls of the hopper, circuit connections for the electrodes, a rotatable receptacle arranged below the hopper and plates removably applied to the periphery of the receptacle.

597,891. Electrically Actuated Lock for Bicycle Racks. Frank V. Walstrom and John Erickson, Chicago, Ill. Application filed November 9, 1896.

There are a locking mechanism, an alarm mechanism, a relay arranged to control the alarm mechanism and a normally closed electric circuit arranged to control the relay.

597,945. Electric Furnace. Charles S. Bradley, Avon, N. Y. Application filed December 12, 1896.

A receptacle contains a charge of material to be operated upon; electric connections are made for leading a current through the charge from an external circuit, including a current-leading electrode extending into the receptacle, and means for effecting a continuous downward movement of the charge relatively to the electrode by a movement of rotation.



NO. 597,891.

597,964. Light Refracting and Magnifying Envelope for Incandescent Lamps. Forest W. Dunlap and John R. Quain, London, England. Application filed June 2, 1897.

A light refracting envelope is formed of a closely wound spiral of glass rod of circular or other section applied upon the bulb of the lamp.

597,965. Coin-controlled Machine. Henry T. Emeis, Salt Lake City, Utah. Application filed September 9, 1897.

Electric circuit-closing devices interrupt the coin in its passage and bring it into operation for closing a circuit, whereby an electric appliance located in the circuit is operated.

597,979. Electric Switch. Jesse L. Hinds, Syracuse, N. Y. Application filed February 1, 1896.

The switch terminals are secured to a base, and a blade is provided for closing the circuit between the terminals, and a back or support consisting of a slotted tube to which the blade is removably secured.

597,985. Electric Meter. Gisbert Kapp, Berlin, Germany. Application filed November 19, 1897. Patented in England April 7, 1892.

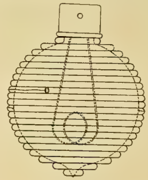
An electricity measuring apparatus has supplemental means adapted to give a separate registry or record of the consumption of energy during any desired period of the day, and means for throwing the same into and out of operation, whereby a registry of the current consumed during certain hours independent or distinct from that of other hours may be kept.

598,001. Electric Switch. James R. Newell, Titusville, Pa. Application filed September 15, 1897.

A pivoted bar of insulating material, conducting plates at each end of the bar, spring plates at each side of the bar having outwardly turned upper ends, a pin in the bar adapted to engage holes in the spring plates, and means for spreading the plates and depressing the bar.

598,033. Electric Signaling Device. Eugene A. Stout, Jr., Philadelphia, Pa. Application filed March 23, 1897.

Features of this invention comprise contact plates and conducting wires connecting therewith, a rotatable push-button having an arm adapted to be brought into engagement with any one of the plates, a bolt having one end projected into a bore in the button, and a spring mounted upon the bolt and performing the double function of holding the contact arm normally out of engagement with the plates and forming an electric conductor between the main and the contact arm.



NO. 596,964.

598,049. Electric Burglar-alarm System. Clyde Coleman, Chicago, Ill. Application filed December 14, 1896.

Two or more sources of electromotive force are provided; a responsive device is subjected to the influence of several sources of electromotive force; an alarm is adapted to be actuated by the responsive device; a multiple permutating device is associated with each of the sources of electromotive force, and means for operating the multiple permutating devices in unison to correspondingly vary the electromotive forces, and thereby maintain the responsive device quiescent, are described.

598,062. Device for Preventing Accidents on Railroads. Hermann Biermann, Breslau, Germany. Application filed April 6, 1896.

A current generator is arranged in the train, with a main-line circuit adapted to be put in electrical connection with the current generator and consisting of the rails of the track and divided in several fields by means of wires, a secondary line circuit comprising wires insulated from each other at the end of each of the fields, the circuit being put in the circuit of the main line, a secondary conductor on the cab connecting the terminal wires of the current generator and containing a resistance and the alarm and safety apparatus of the train, a contact device arranged at the end of each field and comprising a spring-lever adapted to connect the two wires forming the field, and an electro-magnet electrically connected with the main line and the secondary line.

598,063. Electric Burglar-alarm System. Clyde Coleman, Chicago, Ill. Application filed December 14, 1896.

A protective circuit and an individual circuit are provided, and a responsive device is subjected to the combined action of the currents flowing in the two circuits; an alarm is controlled by the responsive device, and a multiple permutating resistance for each of the circuits comprises a number of units of resistance and a plurality or multiple of circuit-changing arms or elements conjointly acting to include the units of resistance in various and successive orders.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, FEBRUARY 12, 1898. No. 7

Louis A. Ferguson Honored.

The Northwestern Association of the Alumni of the Massachusetts Institute of Technology paid a very pleasant and appropriate compliment to Louis A. Ferguson at the annual meeting of the organization in Chicago on February 5th by electing him president on the eve of his departure for Europe. There were a hundred members present at the meeting and the banquet which followed at the Chicago Technical Club, and the event was one of the most successful gatherings in the history of the organization. Frank Wells of the class of '70 was the toastmaster, and in taking the post he made a brief address congratulatory of the success of the reunion. The first address of the after-dinner series was delivered by Captain Andrew H. Russell of the United States army. He was graduated from the Massachusetts Institute of Technology in 1868. The subject of his speech was "The School and the Army." Other responses to toasts were made by George S. Morison, I. W. Litchfield and Severance Burrage. A feature of the evening was the discussion of the topic, "The Proposed Union of Technology and Harvard." The speakers were B. R. T. Collins, '88; Frederick Greeley, '76, and Solomon Sturges, '87. The executive committee which arranged the banquet consisted of: B. R. T. Collins, '88, president; R. H. Pierce, '85, vice-president; Edward M. Hagar, '93, secretary and treasurer; H. H. Cutler, '81; Solomon Sturges, '87; John L. Shortall, '87; Louis A. Ferguson, '88.

The Northwestern Association of the Alumni of the Massachusetts Institute of Technology was formed by the graduates residing in Chicago 11 years ago, and it has continued ever since adding constantly to its membership and influence. Mr. Ferguson, who was selected last Saturday to preside over the association during the ensuing year, was a charter member, and he has always displayed an active interest in the organization. The society numbers among its members some of the ablest engineers of Chicago and the Northwest, and the presidency is consequently looked upon as a very high compliment. That the present incumbent is deserving of this honor his associates in the engineering profession, especially in the electrical field, will testify.

Mr. Ferguson needs no introduction to readers of the Western Electrician. He is general superintendent of the Chicago Edison company, to which position he was appointed by President Insull on June 1st. He is an experienced central-station man and is one of the foremost advocates of that class of service as opposed to isolated plants, especially in the larger cities. He is especially familiar with the Chicago Edison company's plant and the conditions and requirements of that corporation's service, as he has been associated with the enterprise through the several stages of development and expansion that marked the period between the building of the Adams street station and the present comprehensive system. Mr. Ferguson is well equipped for his work by education and experience. He was graduated from the High School of Roxbury, suburb of Boston, in 1884, and immediately entered the Massachusetts Institute of Technology, where he completed his course and from which he was graduated in May, 1888, with the degree of Bachelor of Science in the department of electrical engineering. His thesis work at the Technology Institute consisted in original experiments to determine "The Law of Relation between Candle Power and Current, Voltage and Energy Consumed in Incandescent Lamps." It was about the time Mr. Ferguson was completing his engineering education that the original plans for the Edison system in Chicago were decided upon and the promoters of that enterprise were looking about for competent engineering talent to undertake the construction and operation of the plant. Mr. Ferguson's work at the Institute of Technology attracted favorable attention and he was offered a position with the Chicago Edison company in July, 1888. Shortly afterward he became electrician of the underground department. In 1889 he was made assistant electrical engineer in the construction department, and in 1890 was appointed electrical engineer of the company. Up to this time his experience had been entirely in the engineering department, but he displayed such good judgment in commercial work that was entrusted to him that his ability in this line attracted the attention of the management, and in 1893 his duties were enlarged and the securing of new business on contract basis, particularly among the large downtown retail establishments, was placed under his direction in addition to his engineering and construction work. His duties were gradually enlarged until on June 1st, as already mentioned, President Insull appointed him general superintendent of the company, giving him charge of the operating and electrical engineering departments, as well as the central-station and isolated-plant business.

Throughout his career in Chicago Mr. Ferguson has been progressive and yet conservative, and the experience that he has gained in the development of the Chicago Edison system has made him an authority upon central-station practice in this country. His contribution on "Central-station Advancement" in the Western Electrician of January 1st was accepted as an authoritative statement of

LOUIS A. FERGUSON.

present practice, and was appropriately supplemented in the same issue by an illustrated article on the "Three-phase Transmission Plant of the Chicago Edison Company." Mr. Ferguson was one of the staff of lecturers of the University of Wisconsin in 1895, and delivered a lecture on "Electrical Engineering in Modern Central Stations," which has since been published by the university. He read a paper at the meeting of the National Electric Light association at New York on May 5, 1896, on "The Commercial Value of Acetylene Gas as an Illuminant," giving the results of his experiments made with Messrs. Wilson and Knapp at Spray, N. C., in May, 1895, in the production of calcium carbide and acetylene gas. This paper was published in pamphlet form by order of the National Electric Light association, and comprises one of the ablest contributions on the subject up to the present time. Another valuable contribution was his work in connection with Dr. Louis Bell and James I. Ayer upon the preparation of a suitable specification for a standard incandescent lamp and the determination of a proper method for the commercial application of this standard. The result of this work was presented in a report on "Standard Candle Power of Incandescent Lamps" submitted to the National Electric Light association at Niagara Falls on June 16, 1897. At the convention of the Association of Edison Illuminating companies at Niagara Falls, September 14, 1897, Mr. Ferguson submitted an important contribution on "Economy in Distribution of Electric Energy."

Mr. Ferguson is still a young man, considering the responsibilities of his present position and the record he has made. He is not yet 31 years of age, as he was born August 19, 1867, at Dorchester, Mass, now a Boston suburb. Although a member of several organizations, Mr. Ferguson is not a club man, but in contradistinction may be termed a home man. He is happily married and enjcys a comfortable home at Evanston, Chicago's most beautiful suburb.

Chicago's Electrical Department.

The new Department of Electricity of the city of Chicago is now fully organized. Mr. Ellicott is city electrician, David M. Hyland assistant city electrician, William Carroll superintendent of construction, J. B. Porter chief clerk and R. M. Johnson chief inspector. The last-named gentleman is a 60-day appointee, and will take the civil-service examination. There are nine inspectors and the old force of operators. Now that a separate department has been created for the electrical interests of the city government, the inspection of electrical plants will be systematized to a degree not hitherto attained. Under the ordinance electrical contractors, rather than owners, must report all jobs of new or repair work to the department and must have a permit before beginning work. In this way a more complete record of the electrical installations in the city will be obtained.

For the present the Department of Electricity will remain in the old quarters, adjoining the Fire Department, in the city hall, but as the rooms are crowded and not well fitted for the work, it is likely that new offices will be secured on an upper floor of the building.

City Electrician Ellicott has outlined a policy for his department, and it has received the approval of Mayor Harrison. The principal features of this policy are the following:

"A continued careful investigation of the street railway systems and requiring correction of the faults causing damage to pipes by electrolysis.

"A rigid enforcement of the ordinance regarding the electrical inspection of wiring inside of buildings.

"The adoption of every means possible for the purpose of decreasing the cost of municipal lighting.

"The enforcement of ordinances relating to underground work to be done by the different electric companies, within a reasonable district.

"Putting all important fire-alarm and police lines underground.

"Requiring combination pole lines and removing the unnecessary pole lines.

"The extension of municipal electric lighting.

"Improving the police-telephone system and decreasing the cost of operation."

One of the planks in this platform is about to be enforced. That is the requirement about placing all electrical wires underground in a "reasonable district"—that is, the downtown business district bounded by the river, the lake and Twelfth street. In this portion of the city all the principal electrical circuits are now underground, but there are still a few aerial wires strung over roofs and across streets and alleys to make short connections. Most of these wires constitute the call-box circuits of the telegraph companies, but there are a few telephone wires, one city fire-alarm circuit and probably a number of "pirated" wires. By a recent order of the mayor all electrical wires of whatever description, in the district named, must be taken down by March 1st. The order meets general approval.

It is expected that the special appropriation of $150,000 for electric street lighting extensions by the city will be reported in the general municipal appropriation now under consideration. If this expectation is realized, Mr. Ellicott, acting under the city controller will carry out his plans for new arc-light plants as previously described in this journal. It will be remembered that a special extra appropriation for this purpose was made by the City Council, and that specifications were issued and bids received under this authority. However, Judge Tuley decided that the extra appropriation was illegal, and so action was deferred until the money could be made available as a part of the general appropriation for the city government

Practical Repair Hints.

By B. F. Fells.

Electrical machinery, like every other kind, will occasionally need repairing. At times when repairs are necessary the dynamo tender or other electrical machine worker usually discovers the value of suggestions and methods for quick and effective work, gained from the experience of others, or else he realizes that such help might have been of much assistance to him. Simple expedients and suggestions that may seem trite to some will perhaps still prove of value, and it is with this hope that I give a few "wrinkles" in shop practice that I have tried and found useful.

The commutator is often a source of trouble. In the small sizes the proportions enable the sections to be fairly well braced, as indicated by Fig. 1 in the accompanying drawing. In a large commutator, however, the circle described is of such dimension that the sections must necessarily be nearly parallel, as shown in Fig. 2. The result is that certain influences will cause one or more sections to drop down, as indicated by A, B and C. The mica will remain in position, and, of course, trouble will at once ensue. If but one section has dropped, and this not very far, the trouble may be remedied by grinding or sandpapering the mica and adjoining sections down to the common level. This will answer until the section drops again. If two or more sections drop I have always found it best to reconstruct the work, shaping and adjusting the insulation in such way as to obviate further trouble. In case of the short-circuiting of two sections, resulting in the burning out of an armature coil, use thicker insulation when reconstructing. If the brushes had sparked a good deal, use thinner insulation between the sections, as sparking is often a sign of too thick insulation.

In some types of motors the cams are keyed to the shaft. A case is in mind where one of these keys became loosened, and, to make it hold, the owner put a thin piece of tin (A) alongside, as represented in Fig. 3, in which B is the key. In driving the key home the extra thickness of tin caused the cam to break at the shoulder. The shaft and cam were brought in and the shoulder of the cam repaired, as illustrated in Fig. 4, in which the ring of soft steel, C, was tightly molded around the cam, as shown, and held in position securely by means of rivets. A new key, a trifle larger in proportion, was then substituted for the original key, and the job was complete. The rivets were, of

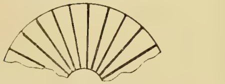


FIG 1

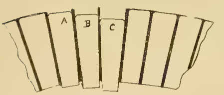


FIG 2

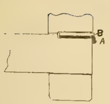


FIG 3

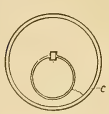


FIG 4

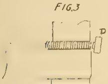


FIG 5

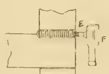


FIG 6

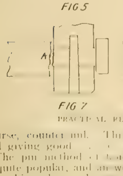


FIG 7

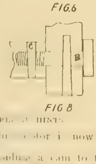


FIG 8

PRACTICAL REPAIR HINTS.

course, countersunk. The motor is now running and giving good . . .

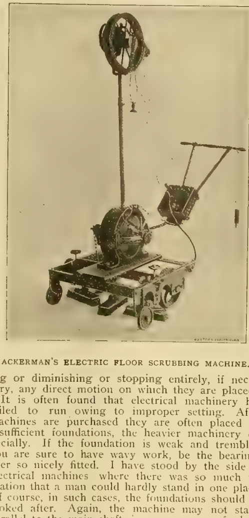
The pin method of holding a cam to the shaft is quite popular, and answers all purposes, but, like everything else in the machinery line, will at times give out. The repairer has frequently to contend with this type. In cases where the head of the pin, D, has broken off, as presented in Fig. 5, the difficulty is to get the remainder of the pin out. It is screwed in, as a rule, and sticks fast. About the quickest way to remove the broken piece is to bore two small holes in the end in which to insert a double-pointed instrument, as E, in Fig. 6. Then put on the wrench, F, and the broken pin may be turned out and a new one put in.

An unusual method of connecting the cam to the shaft is exhibited in Fig. 7, yet there are enough shafts of this kind to make it an object for repairers to be familiar with the most efficient process of effecting a repair in case of the shaft breaking off, as shown at A (Fig. 7). Even down the cam, bore a hole into it about the right size to receive a new shaft, such as is indicated by B in Fig. 8. The manner of securing in place, so that it cannot turn, is by inserting the key, C. This method of repairing these cam adjustments when they break off is lasting and satisfactory.

I have been asked about the differential motion which is now being adapted to certain electrical machinery. In this peculiar motion the driving shaft is the prime mover, and the arrangement of wheels is to modify, increase or diminish the direct motions. Its power of diversity of operation is that for two revolutions of the shaft on the prime mover the differential will give only one. For two revolutions of the shaft with the differential wheel held fast, the socket will revolve twice in the opposite direction. For eight revolutions of the shaft and one of the differential wheel the socket will revolve six times in the opposite direction to the prime mover, and for 200 revolutions of the shaft and 20 of the differential wheel the socket will revolve 160 times in the opposite direction to the prime mover. So it will be observed that this combination of wheels is capable of mofifying, increasing or diminishing or stopping entirely, if necessary, any direct motion on which they are placed.

It is often found that electrical machinery has failed to run owing to improper setting. After machines are purchased they are often placed on insufficient foundations, the heavier machinery especially. If the foundation is weak and trembles, you are sure to have wavy work, be the bearings ever so nicely fitted. I have stood by the side of electrical machines where there was so much vibration that a man could hardly stand in one place. Of course, in such cases, the foundations should be looked after. Again, the machine may not stand parallel to the main shaft, in consequence of which the belt crowds over too much to the fast pulley.

Much trouble has been caused by the overheated journals of fast-running electrical machines. That by far the greater number of such fires are due to the use of bad oils and negligence there can be little doubt. Bad oils and negligence make a fine combination for heated journals. Good oil and negligence are an improvement, but still not a safe combination. Much the best plan to pursue is to get rid of bad oils and negligence at the same time. By so doing much money will be saved and disaster prevented.



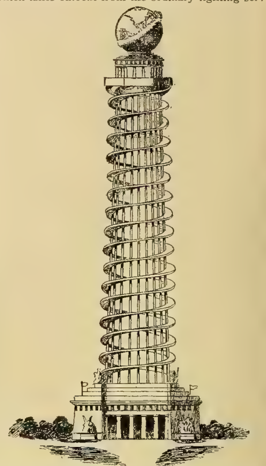
ACKERMAN'S ELECTRIC FLOOR SCRUBBING MACHINE.

Ackerman's Electric Floor Scrubbing Machine.

The labor-saving device which is illustrated in the accompanying picture has been found particularly serviceable in large office buildings and public institutions, department stores and places of amusement or wherever large floor space requires frequent cleaning. The frame carries several scrubbing brushes which are pressed against the floor by springs and are geared to an electric motor so as to be operated at about 400 revolutions per minute. The wheels have rubber tires, and the machine can very easily be shoved along the floor by its handle. It is found, however, that the action of the brushes in rotating tends to draw the machine along the floor, so that the operator has really little more to do than to guide it. When water is thrown on the floor and the scrubbing machine guided over it by the operator the work is quickly done. The front and the sides of the machine are protected by zinc splashboards. It is about 30 inches square and weighs about 300 pounds. The brushes are arranged so that the machine will run close to the baseboard.

The apparatus is operated by an electric motor which takes current from the ordinary lighting service through a flexible cord connection with any convenient incandescent lamp socket. It is only necessary to remove the lamp and insert the plug in its place. The reel at the top of the trolley pole takes up the slack cord. On the handle of the machine a rheostat is placed within easy reach of the operator. The gearing between the motor and the brushes is by means of a sprocket chain leading from the motor to the axle on which the larger wheels ordinarily loosely revolve, and from that axle by another sprocket chain to a shaft connected by bevel gears with vertical shafts operating the brushes. This allows the machine to be easily converted into a hand machine in case current cannot be obtained. It is only necessary to tighten set screws carried in the hubs of the large wheels which bind those wheels to the axle, and thus, when the machine is shoved forward by hand, the large wheels drive the brushes. Of course if the machine is constructed for use where there is no electric power, the motor and its attachments can be omitted altogether, and the connection between the axle and driving wheels made permanent.

In place of the scrubbing brushes, sandpaper blocks or blocks of stone may be substituted, and thus the machine may be used to dress down wood floors or mosaic. The springs always keep the brushes or the blocks in proper contact with the floor. According to the inventor of the machine, H. F. Ackerman of Cleveland, it has been in actual service for two years in the Hickox building in Cleveland, doing work on eight floors in 2½ hours which formerly took 10½ hours, thus effecting a saving of $75 each month. A machine has also been placed in Cleveland's New Lakeside, which is described as the largest and most modern hospital in the world.



ELECTRICAL FEATURE OF THE PAN-AMERICAN EXPOSITION.

Electrical Feature of the Pan-American Exposition.

It is intended that a great spiral railway operated by electric power from Niagara Falls shall be to the proposed Pan-American Exposition, to be held on Cayuga Island, Niagara Falls, what the Ferris wheel was to the World's Fair and what the Eiffel tower was to the last Paris Exposition. General plans for this conception have been made, and the details are being worked out. The basis for the railway is to be a huge circular tower of steel framework, 500 feet high, around which, like the thread of a screw, the spiral railway will run, supported on powerful brackets securely joined to the framework of the tower. The tower will have a diameter of 80 feet at the bottom, and the taper will be 30 feet to the 400-foot level, giving a diameter at that point of 50 feet. Around this tower the railway will run, rising 40 feet to the complete circle, thus passing 10 times around the tower in reaching the 400-foot

level, where there will be a platform which will be the terminus of the line. A ratchet rail will be used for the cars to make the climb, on the same principle as the ascent of the Mount Washington and Pike's Peak roads. The grade of the road will be from 17 to 25 per cent. Protective devices will be used to assure safety, and it is expected that passengers on the spiral railway will be better protected than those on electric or steam railway trains. When the passengers are ready for the trip they will be seated facing outward, away from the tower, and thus the view will grow better and better as the car ascends. Far away in Canada, up the river to Lake Erie, down to Lake Ontario, across one of the most beautiful sections of country to be found in the world, the eye will go with delight. The cars will never meet or pass except on opposite sides of the tower, as the two tracks will be erected on parallel but independent spirals.

At night the whole structure will be outlined in electric lights. Up and down the cars will move, glittering with incandescent lamps, while from the top of the tower a powerful searchlight will illumine the falls, rapids and the exposition grounds. Above this will, a great glass globe will shine with light from within, all going to form a never-to-be-forgotten spectacle. The design was conceived by George A. Ricker, chief engineer of the Gorge road at Niagara.

High Electromotive Force.[1]

By John Trowbridge.

I have lately perfected a large plant for the study of the discharges of electricity through gases which I believe is more extended, and on a larger scale, than any at present in existence; and I have obtained some results with it, especially in the subject of high electromotive force, which throw light upon many theoretical points. The source of electricity which produces the electrical discharges is obtained from 10,000 storage cells. From these cells I obtain very approximately 20,000 volts, and by means of a peculiar apparatus called Planté's rheostatic machine (Fig. 1) I am enabled to obtain over one million volts—which enables me to experiment with powerful discharges in air, more than four feet in length.

By the employment of storage cells in the subject of the discharges of electricity through gases, one can form a fair estimate of the amount of energy that is employed to produce the desired effects—for instance, the X-rays; while with the use of electrical machines or induction coils and transformers it is extremely difficult, if not impossible, to form an accurate estimate. Fig. 2 is an illustration of the type of cells of which the battery consists. Each cell is composed of a test tube 3½ inches long and three-fourths of an inch internal diameter containing two strips of lead which are separated from each other by rubber bands and are immersed in dilute sulphuric acid. The surfaces of the lead strips are roughened by a mechanical device, and the cells are charged in multiple circuit by means of a dynamo machine. When the cells are properly formed each one gives two volts and has an internal resistance of one-quarter of an ohm. The problem of insulating these cells was a serious one; but it was practically solved by mounting the cells in sets of threes, in holes bored in a block of wood which had been carefully boiled in paraffine. The mechanician of the laboratory, George Thompson, devised a simple switchboard which enables me to throw the cells into multiple or into series—to use the entire 10,000, or suitable portions of this number. The battery gives eight amperes of current with 20,000 volts, and this amount of energy is amply sufficient to kill a man. By accident an operator received the shock from only 1,000 of the cells and was badly shocked and burned. It is prudent therefore in experimenting with this battery to use rubber gloves, even in throwing the switches, and it is recommended to employ only one hand covered with a rubber glove and to keep the other hand in a pocket.

I had at first intended to use this large battery in the study of electrical discharges through Crookes tubes, but I speedily found that X-rays could not be excited by a difference of potential represented by 20,000 volts. I found that at least 100,000 volts were necessary to produce them strongly, and I, therefore, resolved to construct a Planté rheostatic machine. The machine is simply an apparatus by means of which Leyden jars are first charged in parallel and are then discharged in series or by cascades. That is, all the inside coatings of the jars are connected to the source of terminal of the 10,000 cells, and all the outside coatings are connected to the positive terminal of the cells. When the cells are charged, the inside of one Leyden jar is connected to the outside of the next, and so on. In this way a very high electromotive force can be obtained. I use 60 Leyden jars in the form of plates of glass 15 by 18 inches, coated on both sides with tinfoil. Starting with 20,000 volts, I can easily rise to 1,200,000 volts.

The mechanician of the laboratory has introduced a notable improvement in the apparatus of Planté. Instead of a revolving commutator such as was used by the latter, Mr. Thompson employed lever arms, by means of which the jars were first charged in parallel and then discharged in series. It was found that the apparatus designed by Planté could not be used for higher voltages than one or two thousand without serious error and loss. By means of this apparatus I can study electrical discharges at least four feet in length—of great body—which are produced by an electromotive force of 1,200,000 volts. This apparatus possesses the great advantage that it enables one to obtain a fairly exact measure of such high voltage. When we reflect that the trolley car employs only 500 volts, and in the system of transmission of power from Niagara Falls it is proposed to use only 10,000 volts, it is evident that the effects produced by voltages of over a million must be of great scientific interest.

The study of such high electromotive forces immediately showed that previous estimates of the electromotive force necessary to produce a spark of a certain length were highly erroneous. For instance, Heydeweiler, a German investigator, believes that Professor Elihu Thomson's statement, that a spark of five feet in length which he produced required a voltage of 500,000, is very wide of the mark, and Heydeweiler maintains that 100,000 would be nearer the truth. I find that even Professor Thomson's estimate must be more than doubled. Experiments with my apparatus show conclusively that the length of the electric spark between points separated more than one inch varies directly with the electromotive force. A spark 48 to 50 inches in length requires an electromotive force of 1,200,000 volts, and a discharge of lightning one mile long would therefore require the enormous number of over 100,000,000 volts. In reflecting upon the development of such enormous energy in the air we can understand why telephone bells ring during a thunder-storm, why subsidiary sparks occur in networks of wires and why telegraphic messages are interrupted. The world beneath the thunder-storm throbs and pulsates with the oscillatory discharges of lightning.

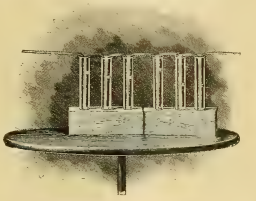


FIG. 2 HIGH ELECTROMOTIVE FORCE.—FORM OF CELL.

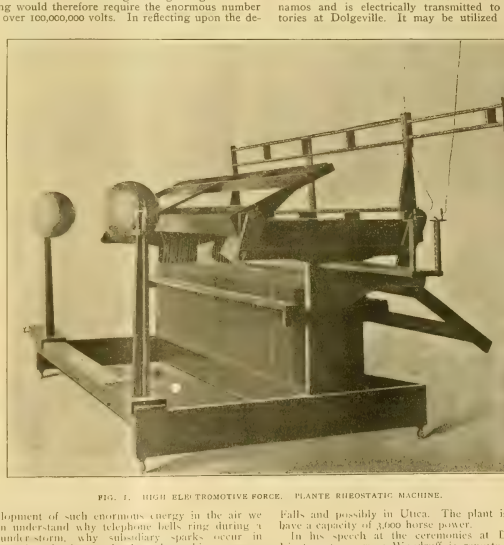


FIG. 1. HIGH ELECTROMOTIVE FORCE. PLANTÉ RHEOSTATIC MACHINE.

One of the most interesting results of my study of powerful disruptive discharges is the discovery that such discharges will pass through glass tubes which are exhausted to such a high degree that they are said to contain a vacuum; for the eighth-inch spark of a Ruhmkorff coil prefers to jump around the tube to passing through the extremely rarefied space in the interior of the tube. Such tubes, however, are brilliantly lighted by a difference of potential of 1,000,000 volts and readily show the X rays, and exhibit the skeleton of the hand in a fluoroscope. The so-called brush discharge from the positive terminal of the Planté machine extends visibly to a distance of over a foot. If the hand is exposed to this brush, it produces the well-known X-ray burn, such as various investigators have received in taking photographs of the skeletons of their hands, or in testing the condition of Crookes tubes by exposing their hands before a fluoroscope. The skin of the hand becomes irritable and turns a bright red color, especially after exposure to cold winds."

This result interested me greatly, for it proved that the so-called X-ray burn could be produced by the brush discharge of very high electromotive force. The extent of the influence of this powerful brush discharge is very great. For instance, photographic plates in a plate holder carefully insulated from the ground and covered with a plate of glass half an inch in thickness show the inductive action of the brush discharge from the positive terminal, which is distant at least a foot. These inductive effects are manifested by star-shaped figures on a photographic plate. They are surrounded by dark clouds. When the burn on the back of one's hand produced by such brush discharges is examined by a microscope, similar centers of disturbance (in this case points of inflammation) are seen. Although the Leyden jars of my machine are carefully insulated on supports of vulcanite which are mounted on dry wood, which in turn is supported on rubber, I can obtain a discharge of more than two feet in length when I bring a point connected to the steam pipes to the neighborhood of one terminal of the machine. The other terminal of the machine is carefully insulated. This experiment shows conclusively that it is of no use to insulate lightning rods. My experiments thus far show that no vacuum which I can produce can resist the discharges which are caused by 1,000,000 volts. It now becomes an interesting question whether there exists mechanical or chemical means by which a so-called vacuum can be produced which will resist such discharges.

Water-power Development in New York State.

The power transmission plant of the Dolgeville (N. Y.) Electric and Power company was formally opened on January 15th. The power of the East Canada Creek is used to drive turbines and dynamos and is electrically transmitted to the factories at Dolgeville. It may be utilized in Little Falls and possibly in Utica. The plant is said to have a capacity of 3,000 horse power.

In his speech at the ceremonies at Dolgeville Lieutenant-governor Woodruff is reported as saying that the Schenectady works of the General Electric company were to be operated by power electrically transmitted from the Hudson. Mr. Woodruff is quoted as follows:

"I come to you, not entirely in a public capacity, but as a manufacturer with business interests of a character similar to yours. One of the manufacturing plants in which I am interested is operated by water power, created by the largest dam in the state, the supply for which, like that of your dam, comes out of the forests of the Adirondack Mountains.

"Only a few years ago our people were startled

1. From the Scientific American.

by the announcement that the power of Niagara Falls was to be transmitted by electricity to the city of Buffalo. Almost before the sensation caused by the thought of such a possibility had abated Niagara was in chains, and her power infused into the arteries of a city which to-day is the second city of our state. Below the dam at Mechanicville, to which I have referred, a dam has just been completed across the Hudson River for the purpose of transmitting electric power to operate the works of the General Electric company at Schenectady. And now comes Dolgeville utilizing the rapid water of the Auskeraga and the erstwhile East Canada Creek to operate not only its own looms and spindles, but also the looms and spindles of Little Falls, and perhaps even the street cars of Utica.

"May it not be that the closing years of the nineteenth century have seen only the first steps in the application of electric power, and that the recent great water power developments to which I have referred are but the precursors of others, which will operate the manufactories of the Empire State, and even, perhaps, the surface, elevated and underground railways of the imperial city at the mouth of the Hudson?"

Electric Headlights on Western Railroads.

The electric headlight on locomotives has been found to have other uses than illuminating the track for the engineer and serving as a warning at approaching crossings. Throwing its powerful rays far into the darkness and silvering the forest foliage or the waters of lake or river, its beams are reflected upon the clouds as the engine takes a grade, and the coming of the train is heralded for miles in advance by signals that may be compared to the flashes of the heliograph from mountain peak to peak, long before the rumble of the train can be heard.

This has been noticed recently on the Monon Route in Indiana, more especially in the southern part of the state, where the line winds among the hills and is visible for short distances only, and where topographical obstructions form a barrier to the sound of the train. The line is a single track and is not provided with the block system, although trains are operated by telegraphic orders, and it becomes of considerable importance for engineers of freight and extra trains to know the whereabouts of trains approaching from the opposite direction, and for agents and flagmen at points where there is no telegraph. Actual observation has demonstrated the fact that the electric headlight telegraphs the approach of a fast train from five to eight minutes in advance of its arrival. This suggests the use of colored disks or other device to signal express or specials, and the use of the stationary searchlight for signaling at stations. It is believed that an excellent field is presented here for development. At any rate, the successful application of the electric searchlight upon western railroads has attracted the attention of practical railroad men throughout the country to the subject.

The apparatus employed is compact, the entire equipment being 26 inches long and 18 inches wide

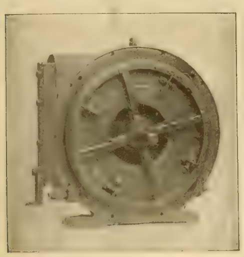


FIG. 1. ELECTRIC HEADLIGHTS ON WESTERN RAILROADS.

and the weight only 250 pounds. It comprises an engine, dynamo and lamp. The engine is a compound steam turbine and is exceedingly simple in construction. There are only two bearings, one 3½ inches long and the other 6½ inches. They are of the very best phosphor bronze, well provided for lubrication, and as the total weight of the turbine wheel, shaft and armature is only 42 pounds, it is clearly evident the life of the wearing parts will be long. It is explained that it makes no difference whether dry or wet steam is used, or a full head of steam suddenly turned on, as there can be no backlash or reaction and, therefore, no evil effects. The speed is 1,800 revolutions per minute, and a novel and ingenious governor regulates the varying load to a degree of perfection seldom equaled in any engine. It is attached directly to the turbine wheel and is designed to run without oil. The speed can easily be increased or decreased by removing a plug in the name-plate and tightening or loosening the screws immediately beneath. A view of the turbine with the cover removed is presented in Fig. 1. The same simplicity of design and arrangement was followed in the dynamo as in the engine, as will be seen by reference to Fig. 2. The armature is mounted on the engine shaft, thus dispensing with couplings, and can be easily taken out by removing one screw. The brushholders are fixed and the brushes can be removed or replaced without changing the tension of the spring. The particular claims for the lamp are

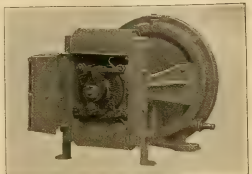


FIG. 2. ELECTRIC HEADLIGHTS ON WESTERN RAILROADS.

simplicity and durability. It is said to be the first lamp to use successfully two carbons on the locomotive, holding the focus accurately. It is provided for adjustment in every direction and is so constructed that any degree of light up to its full capacity can be maintained by regulating the flow of steam. An excellent idea of the mechanism of the lamp can be gained from Fig. 3, and the mechanical details of the outfit will be better understood after an examination of the diagram presented in Fig. 4.

The Pyle National Electric Headlight company of Chicago, which manufactures these headlights, has already equipped trains on the Monon, Big Four and Santa Fe, and reports from the operating departments of these roads indicate that satisfactory results have been attained.

Cabby's Farewell.

[From the St. James Gazette, London.]

So long, old 'oss; you're jest played out, you've taken your last fare,
Your quarters are the knacker's nah, and mine are Lord knows where;
There ain't no room in London nah for either you or me,
We're crahded aht by cabs as go by electricitee.

It warn't all beer and skittles, even in the palmy days,
What with the cove with principles, his legal fare as pays;
But when the "biz" was pretty brisk, and cabby got the pull,
I could plank dahn for the Derby for my fancy arf a bull.

It's nuts, it is, on some fine day, to pick up some young nob,
And drive 'im all the morning till the fare is nineteen bob;
And then he stops at Gresham 'Ouse, and shahting, "Cabby, wait,"
'E takes 'is 'ook the other end aht into Bishopsgate.

Or on a lovely autumn when the rain came dahn in sheets,
Or when a bloomin' blizzard set us skatin' in the streets,
And after you 'ad planked dahn to the yard each bob you 'ad,
And fahnd yerself to balance up a dollar to the bad.

Then to take yer to the stables at the other end of tahn,
And strip yer frozen 'arness off, and rub yer ole 'ide dahn;
And yer got yer jolly skin full, and a decent place to doss,
Which was often more nor *I* got by a jolly site, old 'oss.

But nah—so long, my beauty; for this latest style I bar—
I ain't a going (what do *you* think) to run a motor car;
While there's a crossing to be swept, a job to do no fear—
I reckon I'm too old to turn a bloomnig engineer.

A Discouragement to Business.

"How does the horseless carriage business progress?" asked the inquiring customer of the Irish proprietor of an automatic carriage establishment.

"Sure, there's times it progresses fine, sorr, an' there's times it don't progress at all," replied the proprietor. "Whin the cabs is in order an' goes whizzin' around the strates widout noise or commotion folks looks at 'em wid special admiration an' says: 'Ain't thot a divil av a fine way to get over the ground!' But, sorr, av you'll take my wurrud for it, 'tis a powerful discouridgemint to the business to see t'ree big micks pushin' a played-out automotor out Broadway in the opin face av Hivin an' the interisted pooblic, an' advertisin' the catastrophe be shwearin' thimsilves blue in the fayess at ivery step. A powerful discouridgemint to business it is, an' av it don't stop happenin' on a sinful average av wance a day, I'm goin' to sell out an' go into the perpetuous motion business."—New York Sun.

The Antiquarian City.

In Any Western City.—Little Willie—Mamma, I got so many toys and things at Christmas I don't know what to do, and would like to see something real wonderful.

Mother—Well, my boy, if you are very good we will soon take you to New York, where you can see a horse-car.—New York Tribune.

Municipal Socialism.[1]

PART II.

Mr. Thayer: I have in my hands a batch of 17 reports, such as they are—I should not call more than two of them real reports—from the municipal plants in the state of Iowa. Six or eight weeks ago I was written to by the secretary of a syndicate of eastern capitalists who were about to lose the city service in Tonawanda, N. Y., on the ground of the excellent showing of the Marshalltown plant, which was alleged to be furnishing arc lights for $18 a year. Now I have out of that list three or four reports that are sufficiently explicit so that we can draw some deductions from them.

Among the best of them is the plant belonging to the city of Vinton, a county seat of about 3,000 inhabitants. It seems that this plant was started in March, 1896, to run in conjunction with a water plant which had been running for some time. The original cost of the lighting plant was $12,380. It was installed by the Fort Wayne corporation. The cost up to date is $18,000. I understand that some of the cost is attributable to the fact that they belted their alternating dynamo direct to a Corliss engine and afterward had to tear their engine room all to pieces and put in a countershaft. According to the report the operating expenses were coal $1,400, labor $1,455, repairs $75, other expenses $250, total, $3,200 per year; income from their lights, $3,600. The incandescent lights are all on meters; they charge meter rent; there is a rate of three-fourths of a cent an hour, and I think that bills amounting to over $5 a month are discounted 15 to 20 per cent.; so that their rates are no lower than those of the ordinary commercial plant. Now they are making $400 over operating expenses; the plant to-day has cost $18,000. This plant is run in connection with waterworks, and the cost of the latter figures out about $2,400 with an invesment of $40,000. Now the fixed charges, with five per cent. interest on this plant, are in the neighborhood of $2,000, making the total cost of operation $4,400 per year.

Now in a town of somewhat similar size, Marengo, same amount of wealth and same class of people, they pay for their service $600 a year, and the electric light company furnishes the coal and labor for a waterworks pump.

In the town of Lisbon, there is a Fort Wayne alternator of 90 kilowatts capacity. According to the last reports they are running behind $125 a year. The cost of operating last year was $3,125, and the income was $3,000. They have an investment there of $15,000; and figuring six per cent. interest and 6½ per cent. depreciation, which is certainly low enough, we find that their arc lights are costing them $1,500 per year for 13 midnight arcs; that is over $100 a year. We are furnishing at the same time 18 all-night arcs of 2,000 candle power

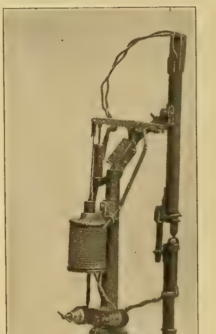


FIG. 3. ELECTRIC HEADLIGHTS ON WESTERN RAILROADS.

for the same money that Lisbon is furnishing 13 arcs.

Here is the Marshalltown report, under the signature of the city clerk. The plant started in 1887. Its original cost was $12,000. They have 68 arcs of 1,200 candle power each, one 80 horse power engine, and the coal cost them $1.27. The clerk says: "This plant is operated in connection with the waterworks plant; the cost of plant is $12,000 for dynamo, two dynamos of 32 lights, 1,200 candle power

each; annual operating expenses have not exceeded $1,200 per year." As near as I can figure that out the plant is operated in connection with the waterworks and it charges the cost of the trimmer and arc light repairs to the waterworks company. I had the editor of our local paper write him and he never answered, and three or four days afterward we wrote him and inclosed an envelope with stamp and he wrote a very long letter in which he stated that he was very sorry that he could not give the necessary information on account of the lack of time, but he advised the editor to come up and see Mr. Pierce, the mayor, and Mr. Pierce would be delighted to show the plant and explain the merits of municipal lighting.

Now the conclusion I want to draw from this is that the city officials of these smaller plants are business men and not electric-light men, and, while they are honest in their intentions, they do not know what their business is costing them, and when they send out reports like those it conjures every plant in the vicinity, because the cost of light is reported as being low and citizens say the light costs us about double what it should, and something is wrong, prices ought to go down. It is our duty, I think, wherever there are any municipal plants anywhere near us to visit them, or get somebody who knows something about it to go there and get the actual operating expenses.

Mr. Pearce: The city of Negaunee has put in a plant. It was installed by the Fort Wayne company. This plant has now been run since the first of September, and they have burned their year's supply of coal in less than four months, which illustrates the value of the figures some of these municipal engineers get out. The estimate for putting in that plant was to supply one alternator of 1,000-light capacity, a 65-light arc machine, and the necessary line construction, for about $10,000. The bids were received and, of course, the Fort Wayne company got it. The amount bid to put in the plant was $9,974; but the extras, etc., I have heard the mayor say, brought the cost close onto $18,000, and they had not finished putting it in yet.

Mr. Debell: We see in most of these figures submitted by municipal plants that the figures are always given in round numbers; they say the expense in this direction is not over $700, while the income is just an even $3,400 and the payroll $1,400. It creates a suspicion in my mind that these sums are all lumped and that there is no actual bookkeeping or accounting embracing any such figures at all. If they do any bookkeeping at all, they should know the cents as well as the dollars. I do not think any private individual would keep a bookkeeper 24 hours whose accounts all came out even hundreds, twenty-fives or fifties.

Mr. Trott of Big Rapids, Mich.: At Holland, Michigan, in March, 1894, they had in operation a 750-light alternator and a 50-light 9½ ampere arc dynamo running 41 street lights. When they raised their money to build this plant they raised $12,000. When they turned it over it stood them in hand $15,000. On the first of October following I went to the city and took charge of this plant, running there a year. Previous to that there was an Edison company operating a three-wire system there, which never had any street lights, and the people thought that the Edison rate that was being charged was terribly high. I believe their highest rates for all-night service for a 16 candle power lamp was $8 per year. The service was deemed defective in some ways, and the city said that inasmuch as the Wolverine company charged $8 they would put in their plant and cut the price in two. So a plant was built for them. In December the attention of the board was called to the fact that their machine was carrying about 900 lights at those rates, which was its full capacity. At the spring election they asked for a further issue of bonds of $10,000 to extend the plant. They got their $10,000 and paid the Wolverine company $6,000 cash for line, dynamos and one large boiler, leaving them with two engines on an investment in hand them in hand over $18,000 cash. Then they got the whole thing and said we are doing this too cheap, and put the rates up, and they closed all night rates to $12 a year, and meter rates to 6 of a cent per hour per lamp. The board of public works estimated that in running 41 street lights at 12 o'clock moonlight schedule, it was costing them $60 a year for each light, when everything possible was charged to the water department. The press-ure time the amount of bills allowed by the board on account of this electric lighting plant, including labor, fuel, supplies and repairs, taking into consideration the city marshal's report as to collections every month, still showed that they are running behind. Their great earnings do not materialize.

At Grand Haven there is another plant in practically the same condition. A few people there, through personal spite, worked up a deal to put in a plant. Now, Grand Haven owns a plant of its own. The other plant is shut down, and the city plant is run about half the time.

In Big Rapids they have a fight on, too. We have the lowest rate in the country and have had for three years. A short time ago it was charged that we were not furnishing what we contracted to do, so they decided to make a test. They sent to Detroit and got a couple of so-called engineers, who came up with voltmeters, went to the station, read an ammeter on the circuit, lowered one lamp, read that lamp for five hours, found that it averaged 403 watts, and then they went back to Detroit to get information to enable them to write their report!

Then the mayor of the city appointed a committee to ascertain the cost of building a city plant for 50 arc lights, distributed as they are now required, through 15 miles of circuit. The committee consisted of inexperienced men, who reported, after asking a few parties what they could do, that they could build this plant for $5,000 and put it in operation with a 50-light outfit complete. Then the mayor came out in a statement that he could build it for less than $5,000, and now he proposes to start a plant running for $7,000, operated on a moonlight schedule, to furnish light for $700 a year for 50 lights, and on an all-night schedule for over a year. We have tried to do business with the city of Big Rapids, offering them very low rates, but now we have got to accept their figures or they will put in a municipal plant.

In regard to Bay City, it may be said that it had an old Fort Wayne Jenney plant giving very poor service. Every time a thunderstorm came up it was shut down, and when oil and waste were needed a messenger was sent over to the waterworks department, where he got it free of expense. They threw out a while ago all their old machinery and put in a new outfit; but they did not charge that up to the expense of operating; no, that was impossible!

Right north of us, 16 miles, is Cadillac, and they will soon have a municipal plant there.

Mr. Ralph: I have had no trouble in Owosso, but the little town of Corunna, to which we also furnished some arc lights, has given us some trouble. I made a contract with the latter place some time ago, for five years, and after that contract had been in existence less than a year they elected a new council, which wanted to break the contract and eventually did so. That contract was $50 a year for 22

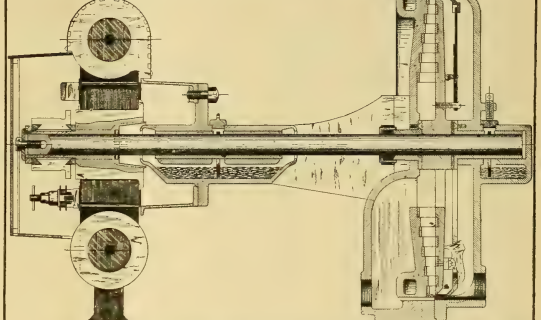


FIG. 4. ELECTRIC HEADLIGHTS ON WESTERN RAILROADS.

lights. Now, those were 1,200 candle power lights, and I had quite a number of letters written to me, asking me why I made such a low figure, but I have a street railway running over there, and my excuse is that it was at some advantage to have that town lit up at night on account of the railway; consequently I charged up $10 a light to the railway account, making the same price that I was getting from Owosso, $60 a year. After a while this contract was broken and they did not pay me for lights, but they made a settlement on a $60 basis, and went along for a couple of months and eventually had the lights shut off. Now after they had done that they had an election, and it took a two-thirds vote to bond the city to put in a municipal plant. They lost the election—they did not get a majority on the vote. After that they concluded they must make some arrangement with me, and the council drew up a very nice contract, in which they offered me $42.50 per year for lamps. After that an irresponsible person came along and claimed that he would accept the contract if they would give him a franchise. Then they had a meeting in which they passed an ordinance giving him a 30-year franchise and a 10-year contract at $42.50, but although two months have elapsed the plant has not been built nor has the contract been accepted.

New Weston Enterprises.

From a recent issue of the News of Newark, N. J., the following interesting announcement is taken:

"Besides the Weston Electrical Instrument company, a number of other concerns in the same line of business will, it is said, in the spring locate their factories near Waverly. These others are the Weston General company (capital, $2,000,000), the Weston Electric Appliance company, (capital, $750,000) and the European Weston Electric Instrument company, which manufactures for the European market and is capitalized at $200,000. The South Newark Land and Improvement company, with a capital of $50,000, is also interested.

"This project, when completed, will form a colony of electrical factories, and the army of workmen employed therein and housed in the immediate neighborhood will ultimately, it is thought, constitute a little town.

"Edward Weston, the electrician, is at the head of the undertaking. The Weston Electric Instrument company, which has its headquarters at William and Shipman streets, Newark, has grown so rapidly in recent years that its present factory was found to be too restricted for its needs. A plot of ground was purchased some time ago on Frelinghuysen avenue, near Waverly, with the intention of locating new works there.

"An especial inducement was found in the fact that in that immediate neighborhood a water supply of 3,000,000 gallons a day could be relied upon, a most important consideration in choosing a site for the company's purposes.

"The plot has a frontage of from 1,600 to 1,800 feet on Frelinghuysen avenue, and runs west along the old road to the tracks of the Lehigh Valley railroad. Besides that property, the company also came into possession of a strip of land running east from the Waverly Hotel to the Pennsylvania railroad station, besides one or two adjoining tracts. It is here that the electrical industry will construct its various works and its homes for the employes."

Municipal Ownership in Milwaukee Politics.

A new factor has appeared in the politics of Milwaukee. In announcing his candidacy for mayor, Henry J. Baumgaertner positively declared that, should the question of municipal ownership be ignored in the Republican platform, he would not accept the nomination, even if offered to him by acclamation. To make a municipal ownership pledge in the platform would mean for the party to promise to increase the bonded indebtedness of the city, which has already reached its constitutional limit, and such a promise could not be carried out. The increase of the city's debt is a precarious question, which recently was ventilated in a local court, and later in the Supreme Court of the state. The garbage bonds were declared illegal and had to be canceled before sold, and, it is believed, all other new bond issues may meet the same fate.

Where American and English Practice Agrees.

[From the London Electrical Engineer.]

Litigation has absorbed too much of the profits arising from electrical engineering, and we regret to note that the present year is not likely to be free from expensive patent-law disputes. The meter patents will be responsible for at least two big battles, which will take away from their ordinary business much of the energy of the firms involved. Another fight is likely to arise over the enclosed arc lamp patents. The broad principle of burning an arc in an enclosed space is free, but the details of how to do this are patented, and infringements of these patents threaten to result in law proceedings. This we regret, as a small royalty to the inventor, if his priority is certain, is far better than spending many times the amount on lawyers.

I. S. Moe of Moeville, Wis., is about to put in an electric-light plant at Zumbrota, Minn. He requests quotations from manufacturers and others for a 500-light plant.

Western Electrician.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CIRCULATION, 20,000.

State of Illinois, County of Cook—ss:

Thomas Jansen, being duly sworn, deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the foreman of the printing department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the printing of No. 24 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were printed by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified. And further this affiant sayeth not.

THOMAS JANSEN.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES, Notary Public.

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February 23, 1895.	52	68	5,593
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No other electrical journal has ever equaled this record of 8,643 square inches of genuine full-paid advertising in a single issue.

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An excellent suggestion is furnished the postal authorities in the action of the London postoffice in starting "a service of electric delivery vans between St. Martin's-le-Grand and Paddington Station." At present in the larger cities of this country the trolley service has been utilized to improve the local postal service. Why not go a step farther and establish a system of electric wagons for districts not covered by the street-railway lines? Such a system could be economically maintained and would prove a valuable auxiliary to the present mail-car service on the trolley lines.

The incorporation of a company to build an elevated electric railroad in the heart of the city was the first intimation to the people of Chicago that such a plan was contemplated. The project is backed by the Chicago City Railway company, and will be utilized by that corporation, if built, to carry its electric cars through the congested retail district. It is the purpose to construct an elevated road from South Water street in Dearborn to Polk street, thence in Plymouth place to Fourteenth street, and thence in Dearborn street to Thirty-ninth street, provided the right of way can be obtained.

After a year's work the committee appointed by the Chicago Electrical association to make a group of diagrams of the more common parts used in electrical construction, for the purpose of originating a standard code to be adopted by the Patent Office, has concluded its labors and made its report, which, together with the drawings, will be forwarded to Washington. The society will take steps to have the code adopted by the government. More than eighty diagrams were selected, covering all the more simple devices in electrical construction, and a standard drawing made of each. The idea is certainly an excellent one and contains many meritorious features.

The spread of populistic sentiment is noticeable in many bills that are introduced in Congress and in the state legislatures. A bill is now before the United States Senate proposing to tax the capital stock of every railroad holding a franchise or hereafter acquiring one under the District government, and upon every association or corporation doing business in the District of Columbia, at the rate of one-fourth mill for each one per cent. of dividend declared, if such dividend shall amount to six per cent. of the capital stock. In the event that it is less than six per cent., or that no dividend is declared, then the tax would be 1½ mills upon each dollar of the market value of stock. It is not feared that the Senate will pass such a measure.

With the remarkable increase in the demand for storage batteries abroad, attention is directed to the high price of accumulator boxes, or "recipients," as they are termed on the Continent, to distinguish them from what is technically termed the "cell," and also from the outer boxes. Manufacturers have found it necessary to offer an inducement for the invention of a new material to be used in this class of work. In a recent discussion at the Institution of Electrical Engineers in London, reference was made to the "breakages of ebonite cells, which, on the average, may be taken to cost 10 shillings apiece." Celluloid had been proposed and used to some extent, it was said, as it was not liable to fracture, but its great combustibility constituted so great a danger that its employment on a large scale was out of the question. American manufacturers will doubtless follow the discussion of this subject with interest and avail themselves of the experience of foreign engineers. The expansion of the storage-battery business in this country during the last few years has been truly remarkable, but well-informed experts believe the development thus far is nothing to what may confidently be expected in the immediate future. Anything tending to cut down cost and improve the durability of the battery will, therefore, be a valuable acquisition.

The late commissioner of patents, Major Butterworth, labored earnestly during his entire public career to improve the condition under which that important branch of the government service was conducted, but his appeals were not always successful, and, as a result, it is announced that a deplorable condition of affairs exists, which is due to the smallness of the working force. The situation is becoming more serious every day. The examiners are from three to four months behind in their work, and some divisions of the office are as much as six months behind. There are on hand awaiting action 13,000 cases, of which 9,600 have never been looked at, and it is probable that in the next four months the business will largely increase. March, April, May and June have heretofore been the heaviest months of the year, and there is no reason to doubt that the record will be kept up. The officials estimate that in that time 14,000 new cases will be received. The outlook, it will be seen, is anything but favorable. When it is remembered that last year the Patent Office turned into the treasury, after paying its running expenses, $317,135.05, and that the books of the treasurer of the United States show a total of $5,093,614.23 paid to the general government by the Patent Office after paying all its expenses, it is not to be wondered that inventors are protesting against delay. They are certainly entitled to prompt and efficient service, but they do not receive it. As a matter of fact, the government requires them to pay for the work in advance, and then they wait for months before having their applications considered. So far as the present force goes it is efficient and trustworthy, but it is not large enough to handle the business, which is growing every year. The condition of the Patent Office demands immediate attention, in the interest not only of the inventors, but of the manufacturers of the country as well.

At last the electric railway may be said to be making some advancement in Great Britain, although it must be admitted that the showing thus far is not at all complimentary to the enterprise of the nation. Comparison is invited between the table of electric railways and tramways published by the London Electrician on January 21st, and the corresponding table published a year ago. This year's statistics show that there are now 23 lines in operation, that the construction of 25 others is sufficiently far advanced to make it probable that they will commence running before the year is ended, and that there are now projected schemes for the construction of 10 underground electric railways in London and 48 light railways and tramways in that city and the provinces. The lines in actual operation, together with such as will commence running in a very few weeks, comprise over 150 miles of track, while the aggregate track of the lines working and in course of construction approximates 400 miles. After much discussion and hesitation English engineers have come to the conclusion that they cannot do better than follow in the footsteps of their American brethren. By far the greater number of the companies mentioned in the list this year, whether as being in operation, in process of construction or merely projected relate to the overhead trolley system. Neither the storage-battery car nor the conduit system has advanced, and no surface-contact system is reported in the United Kingdom, while the third-rail conductor system has been reserved exclusively for underground and elevated railways. It is contended that electric traction construction shows no sign of crystallization, for newer methods and improved details of plant are continually being introduced. Here, too, the English engineer follows American methods closely, and as the London Electrician says: "Perhaps the most interesting illustration of this is the decision of the New General Traction company to depart from the custom hitherto universal in this country of mechanically jointing and bonding tramway rails, and to adopt, in the new lines about to be equipped at Coventry and at Norwich, the Falk system of cast-welding rail-joints, which has proved so successful at Chicago and in other parts of the United States. British tramway engineers, whether directly interested in electric traction or only indirectly, will watch closely the process of acclimatization of cast-welding in this country. Probably, on the whole, our fickle climate will prove less trying to the cast-welded joint than the great extremes of temperature it has had to withstand in the climate of some parts of America." It would seem as if the engineers of England had about decided that their conservatism has been satisfied and the time was ripe to appropriate every valuable feature that had been developed in American street railway practice.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Minnesota Central Telephone company is an applicant for a franchise into St. Paul for long-distance telephone service. The company is one of four companies comprising the Western Electric Telephone system, which has 3,000 miles of toll lines in operation in Southern Minnesota, Northern Iowa and South Dakota. This company has just been granted admittance to Minneapolis by unanimous vote of the council.

The Wisconsin Valley Telephone company has completed a line between Eau Claire and Ashland, Wis., and put it in operation.

The local telephone company at Watertown, S. D., will improve its service by putting new receivers and transmitters on its instruments.

The Viroqua Telephone company of Viroqua, Wis., recently provided a concert over its wires for every town and village on its circuit, which covers Southwestern Wisconsin.

A telephone company has been formed at Crawfordsville, Ia., to build a line to Washington, Ia.

Steps have been taken at Mankato, Minn., to form the Mankato Citizens' Telephone Exchange. Articles of incorporation will be prepared at once.

The Fountain City Telephone company will extend its lines from Fountain City, Wis., to Cream, Lincoln and other points in the northern part of Buffalo County.

The Rocky Mountain Bell Telephone company will build a line from Great Falls, Mont., to Fort Benton.

The Wisconsin Telephone company is preparing to increase its toll lines between Milwaukee, Green Bay and Oshkosh, Wis., and also from Oshkosh to Menominee, Mich.

The telephone exchange has been completed at Sparta, Wis., and is operated by the Monroe County Telephone company.

The state auditor of Minnesota proposes to tax the property of the American Telephone and Telegraph company in Minnesota. The company returned the blanks forwarded for a return of its property with the reply that it had no taxable property. The auditor then notified the auditor of Hennepin County that the company's property had escaped taxation. The company's headquarters in the state are in Minneapolis, where it will be taxed, if at all. It is too late to place the tax on the rolls this year, but it can be entered next year for back years.

A stock company has been formed at Litchfield, Minn., to establish a telephone exchange there.

A special act legalizing the incorporation of the Mutual Telephone company of Des Moines, Ia., will be introduced in the Legislature. The company filed articles in regular form, but failed to publish them within 90 days from the time of filing, as required by law. This company now has 1,015 instruments in service, the largest exchange in the state, it is said, and has orders for 70 more. Its switchboard is filled and another board of 100 drops has been ordered.

The little town of Fairmont, Minn., has 121 telephones in use. The promoters of the local exchange have arranged for an equipment at Lakefield.

There is a fight on at Great Falls, Mont., between the Bell company and the local independent company. The Bell company has stolen a march on its rival by securing the Northern Montana company's system, which has been working with the independent company. The latter claims a contract with the Northern Montana, including a lease of the line for a year, but the records fail to show it.

The Rocky Mountain Bell Telephone company will erect a handsome building in Great Falls, Mont., to cost about $10,000.

The Midland Telephone company has been granted a franchise by the county commissioners in Dickey County, N. D. The company's headquarters are at Ellendale, N. D.

Telephones in Washington.

The House of Representatives has adopted an amendment to the District of Columbia appropriation bill fixing the price of telephones in the District of Columbia at $50 per year when on a single wire, and with proportionate decrease on wires on which more instruments are in use. The House has several times adopted such an amendment, but the Senate has invariably defeated it. The price for a single-wire telephone is now $100, and the residents of Washington think they are imposed upon. Recently the telephone company placed pay slot machines in hotels in order to prevent the guests from getting free telephone service. This step has aroused great hostility, and a concerted attempt will be made for more liberal service. The proprietor of a small hotel has brought suit against the company and demands the right to use the telephone in his hotel without being compelled to pay for each service. His place of business downtown has a telephone paid for by the year, and yet he is debarred the privilege of receiving a message from his hotel unless the sender pays the regular fee. The decision of the court in this case will no doubt affect the action of Congress upon the amendment reducing the price of telephone service.

A bill has been introduced in the House of Representatives to authorize the Automatic Telephone Exchange company, limited, to construct, operate and maintain a telephone exchange in the District of Columbia. The company has been formed under the laws of West Virginia. The bill carries with it power to lay conduits through the city and district, and establishes the rates to be charged for service as follows: Dwellings within a radius of one mile from the central exchange, $3 per month, inside two miles $4, and $1 per month additional for each additional mile; business purposes, $4 inside of one mile, $5 inside of two miles and $1 additional for each additional mile thereafter. The work of installation must be begun within six months after the passage of the bill, and 3,000 telephones must be connected within one year, under bond of $50,000.

Hudson Telephone Company.

Application has been made for the appointment of a receiver for the Hudson Telephone company, which was organized in Jersey City about a year ago. Manager G. H. Atkinson filed his resignation with the board of directors several days ago, and the president, Charles B. Thurston, resigned on February 4th. A large number of the stockholders have been at variance with the managing officers. The principal mover in the present crisis is Thomas Hill, who owns the building on Henderson street, Jersey City, where the company has its main offices. He is backed by 25 stockholders, who hold in the aggregate over 800 shares of stock.

It is charged in the application for the appointment of a receiver that the company was organized in the interest of the Best Telephone company, which is in process of liquidation. According to the bill of complaint, the Hudson Telephone company was to pay certain royalties for the use of the transmitter and receiver patents held by the Best Telephone company, which royalties, it is alleged, are excessive. The bill prays that the contract between the companies be brought into court for review. The bill further alleges that the Hudson Telephone company is interested in the New Jersey Telegraph and Telephone Construction company, and that the promoters of the former practically contracted with themselves in awarding the contract for constructing the lines, which, it is alleged, was never advertised according to law. It is alleged that several heavy judgments are pending against the company and that it is practically insolvent.

The concern started with a capital of $300,000, divided into 30,000 shares of $10 each. Mr. Atkinson is reported in an interview in the New York Sun as follows: "The concern is perfectly solvent, but some of the stockholders are entirely unreasonable in their expectations. The allegation that I am in any way connected with the New York and New Jersey Telegraph and Telephone Construction company is untrue. I am not now, nor have I ever been even remotely identified with that concern."

Telephone Legislation in Illinois.

Chicago telephone manufacturers propose to wage a vigorous warfare against a measure now before the Illinois Legislature which it is claimed will work great harm to the independent telephone movement, if passed.

"By affecting the interests of the independent telephone companies now operating in the state, to say nothing of those being organized, the measure will injure the people at large," said Vice-president W. A. Bisland of the Western Telephone Construction company. "The bill provides that after making a statement to the auditor, the person or corporation making the same shall pay a tax of $10 for each telephone connection, and the further sum of $50 for each telephone connection with a device known as a telephone slot arrangement. This seems to be the Bell method of fighting the cheaper rates that are in vogue among the independent companies now giving towns and farming districts in Illinois good service. The measure will not hurt the Bell company as much as the independent companies, for the reason that the older corporation feels itself well intrenched by the occupancy of the field in the larger cities.

"The big cities pay the exorbitant rates demanded by the Bell company and the small cities depend to a great extent upon the long-distance connections with the larger places. The Bell company is therefore in a position to pay to the parent company at Boston its unjust rentals squeezed from the people. We propose to defeat this bill if possible and have advised the members of the House of Representatives and the senators from Cook County to fight the issue."

Large Railway Generators.

The largest generator for electric traction work ever built is now under construction at the works of the General Electric company at Schenectady, N. Y. When finished it will be installed at the Logan street station of the Louisville Railway company at Louisville, Ky. On account of its large diameter the armature of this generator cannot be transported over the railroads in its completed state either erect or on its side. The generator will, therefore, be assembled in Louisville. The completed machine will have 22 poles, an output of 2,400 kilowatts, or 3,000 horse power, and will be driven at a speed of 75 revolutions per minute by a 4,000 horse power, cross-compound engine, to be furnished by the Allis company. The generator will be constructed to stand an overload of about one-third, so that the capacity in cases of emergencies may equal 3,200 kilowatts, or over 4,000 horse power. The principal dimensions of the machine will be as follows: Diameter of field frame, 19 feet; width of field frame, 4 feet 1 inch; diameter of armature, 12 feet 9 inches; diameter of commutator, 9 feet 8 inches; diameter of shaft, 2 feet 3 inches; total weight of armature and commutator, 83,000 pounds; width of armature, 5 feet; width of commutator, 21 inches; total width of generator, 77 inches; total weight of generator complete, 174,000 pounds. Previous to the manufacture of this machine the largest generators constructed for electric railway work were those of 2,500 horse power, the first of which was used in the Intramural power house at the World's Fair. Dynamos of the same enormous output have since been installed in Philadelphia, Boston and Chicago. Four are also operating in the Kent avenue power station of the Brooklyn city railroad, and two of similar size are now being added. At present this power house contains the largest single exhibit of moving machinery in Greater New York. In no other city of the state, with the exception of Niagara Falls, can 10,000 horse power in engines and dynamos be seen in almost constant daily operation.

Electric Railways in Massachusetts.

[From the Boston correspondent of the Western Electrician.]

The Massachusetts Board of Railroad Commissioners has transmitted to the state Legislature the first part of its report for 1897, dealing particularly with electric-railway travel to and from Boston and electricity in railroad operation. The report says:

"It appears that the railroads entering Boston on the north have suffered in the last four years a diminution of 13.2 per cent. in the annual number of passengers carried to and from the city, and those entering on the south of 11 per cent. The loss of the New England road (22.2 per cent.) is the largest, and that of the Fitchburg road (4.6 per cent.) the least. The losses of the other roads range about midway between these extremes, the average loss for the six roads being 12.2 per cent.

"In striking contrast to the showing of the railroads in this respect is that of the five electric street railways whose lines run from or into the city of Boston—as appears in the table:

STREET-RAILWAY PASSENGERS ON BOSTON AND SUBURBAN LINES.

Railway Companies.	No. of passengers in 1893.	No. of passengers in 1897.	Increase in number.	Percentage of increase.
Lynn & Boston	21,682,163	27,386,847	5,704,684	26.3
Norfolk Suburban*	....	1,955,119	1,955,119	....
Quincy & Boston	922,388	2,358,854	1,436,466	155.7
West End	133,863,618	172,554,513	38,690,895	28.9
West Rox. & Roslindale†	....	1,045,088	1,045,088	......
Totals	156,468,169	205,300,421	48,832,252	31.2

*Commenced operation in May, 1894. †Commenced operation in September, 1896.

"It is seen that from 1893 to 1897 the number of passengers on the West End railway, which carries over five-sixths of the whole number included in the table, has increased at the rate of 9,672,700 passengers per year, amounting to an increase of 28.9 per cent. for the four years; and on the five railways taken together, at the rate of 12,208,000 passengers per year, and 31.2 per cent. for the four years. A very considerable portion of the travel on these railways is not, of course, travel to and from Boston; but there is good reason to believe that the latter travel has grown at as rapid a rate, to say the least, as the other travel on these lines.

"In the absence of data for a more exact statement, it appears to be a safe estimate that in the last four years the annual amount of suburban travel to and from Boston on the railroad lines has diminished in the aggregate not less than 10 per cent.; and on the electric railway lines has increased more than 25 per cent. This shifting in the current of the traffic in question is not to be attributed in the main to anything that the railroad companies have done or have failed to do. It is the result of well understood changes in the conditions of such transportation, for which the railroad companies are not responsible, and which they are practically unable to control."

Under the caption "Electricity in Railroad Operation" the board says:

"It is now nearly six years since (by St. 1892, c 110) the railroad corporations of this state were 'authorized to operate their railroads by electricity.' It will be interesting to note the progress that has thus far been made by our railroad companies in the actual use of this motive power.

"In 1895, the Nantasket Beach railroad, a spur of 6.95 miles in length from the South Shore branch of the Old Colony system, used mainly for pleasure and excursion travel during the summer season, was reconstructed for electric operation by the overhead trolley system. A description of this line and of the methods of its equipment and successful operation was given in the report of two years ago, and need not be here repeated.

"In 1896, a section of the South Shore branch, 3.80 miles in length from the junction of the Nan

tasket Beach line, was equipped for electric operation by the third-rail system, the power being supplied from the existing power station. Both of these lines are operated under lease by the New York, New Haven and Hartford Railroad company; and in the annual statement of the directors of that company, dated September 12, 1896, the following is said in regard to the success of the latter experiment: 'The use of electricity as a motive power has been extended as foreshadowed in the last statement. On the South Shore branch of the Old Colony system the current has been successfully and economically conveyed in a third rail insulated upon wooden blocks in the center of each track. The results have surprised experts, and it is now probable that a third rail will be laid at various points upon the company's property during the year to come. Short branches to the centers of business and population may then be constructed from the company's lines.' The same company has also made preparation for the use of electric motive power on some of its lines in the state of Connecticut—as appears in the last annual statement of its directors, dated September 11, 1897: 'During the fiscal year a new electric power house has been constructed at Berlin, Conn. It is so situated that the current may be applied in four different directions on this road, and may also supply the New England railroad, via New Britain to Hartford and to Bristol. Its line between New Britain and Hartford has been running since May 24, 1897.' This further and fuller statement regarding the last-mentioned line is found in the recent annual report of the New England Railroad company, under date of September 17, 1897: 'During the year this company has laid a third rail on one of its tracks and prepared the track between Hartford and New Britain for operation by electricity. It has been so operated since May 24, 1897,

GIANT BRAZER.

and its efficiency has been such that the company may extend the third rail toward Bristol the coming year. Frequent and rapid communication certainly develops suburban travel, and electricity seems to be the best and most economical power for this purpose.'

"The section of the New England road referred to, between Hartford and New Britain, is 9.10 miles long. It appears, therefore, that the Massachusetts companies have equipped in all 19.85 miles of their lines for electric operation, 6.95 miles by the overhead trolley, and 12.90 miles by the third-rail system. The use of steam power on these lines is also continued, as traffic may require.

"In the twenty-seventh annual report of the board (January, 1896, pp. 10-26), the utility and limitations, in its present development, of electricity as a motive power in standard railroad operation, were considered at some length. Nothing appears to have occurred since that time to call for a renewal of the discussion, or to require any substantial revision of the views and conclusions then expressed.

"The practicability of the use, under favorable conditions, of a third rail for the transmission of the electric current on surface roads (contrary to the then generally accepted opinion of electrical experts) is perhaps the most important fact of more recent demonstration. The third rail has manifest advantages in point of practical convenience over the overhead trolley. It has also the disadvantage that it cannot be laid with safety upon the surface of highways and other traveled places where crossed by the railroad at grade, and is therefore completely adapted only to sections of railroad that are free from such crossings. Neither has it as yet been put to the test of all the possible vicissitudes of a New England winter. Improvements in its construction or adaptation to the use in question may doubtless be made.

"Our code of railroad laws has been framed with reference to operation by steam power only. These laws contain many specific provisions and requirements relative to the equipment of locomotives and cars and trains with devices and appliances for the security of travelers on the railroad or highway and for the protection of employes, or to the conveyance of baggage and other property usually carried on passenger trains, and to various other details of railroad equipment and operation. Some of these statutory regulations will be found either to have no proper application or to require some modification in order that they may have a reasonable application to the rolling stock and methods of operation best adapted to a safe and efficient electric service. There may be occasion to ask the Legislature to consider some such changes in the existing railroad laws at the present session; and such consideration is respectfully recommended."

Keystone Arc Light Voltmeter and Ground Detector.

The Keystone arc light voltmeter and ground detector, herewith illustrated, combines in one instrument a voltmeter which will indicate the actual voltage of each circuit, or the total voltage of the generator, and consequently the number of lamps burning, and a ground detector which will indicate a ground and determine its character and location. It will indicate the character of the ground, its resistance and its location on the lines by taking three readings and equating them in simple formulæ. It can be used when the circuit is alive, thus giving results under working conditions. It replaces a cable-testing set which has proved extremely unsatisfactory owing to the many microphone contacts in circuit. It is self-contained, well made, accurate, reliable, dead-beat, unaffected by external fields or changes in temperature, easy and safe to manipulate and low in price. In connection with a set of switches and a battery of cells, or an ordinary incandescent circuit, it can be used to test the continuity of the line and the resistance from line to earth during the day, and for this purpose will be found much easier to handle, more accurate in results and quicker in action than any galvanometer and bridge method.

An idea of the general appearance of the instrument may be obtained from the cut. It consists of a compound galvanometer system, mounted in a case which effectually shields the instrument from the influence of external fields. This case is finished in oxidized copper, well lacquered, and presents an attractive appearance. The scale is practically uniform from zero to maximum reading, indications are dead-beat, and the temperature coefficient of the wire employed is so small that external changes of temperature make no difference in indications.

In setting up the instrument all that is necessary is to secure it to the switchboard by means of the lugs provided, taking care that the pointer stands at zero when no current is passing through the instrument.

Explicit instructions accompany each instrument, giving directions which will enable any switchboard attendant to set the instrument up and operate it successfully. The Keystone Electrical Instrument company of Philadelphia manufactures this device.

Giant Brazer.

An illustration is presented herewith of an entirely new brazer, just put on the market by the White Manufacturing company of 158 Indiana street, Chicago, and invented and patented by John C. Dupee, superintendent of the company's factory. This brazer has three new features, namely, the burner, a swing joint on the feed-pipe to the burner, and the rack for handling the work. The principle of the burner is practically the same as that employed in the kerosene-oil burner of the mammoth brazer, brought out by this company sometime since, but is provided with a larger generator. The giant burner thus constructed is equal in capacity to the ordinary two-burner brazer, although using less oil. The orifice through which the oil passes is but .34 inch in diameter, which could not consume more than half a gallon of oil per hour at a pressure of 50 to 60 pounds. This brazer is operated under a range of 40 to 70 pounds air pressure. A great advantage is gained by having a single burner of this power, as a stronger flame is thus concentrated upon a piece of work, enabling better results to be accomplished than are ordinarily expected from a brazer. The swing joint enables the burner to be used at any desired angle, permitting the flame to be even directed vertically or straight downward if needed. This is particularly desirable in bicycle work. The illustration shows the brazer in use on a large frame for a tandem or a triplet. The swing joint is also useful in cases in which it is easier to take the brazer to the work than the work to the brazer. The flame can then be directed exactly where it is wanted. The back is adjustable in height and is fitted on a movable stand which can either be used in portable form or screwed to the floor. The spelter cup is also adjustable and may be moved up or down or around on any side of the rack to suit the convenience of the operator. The back is lined with firebrick, is set at an oblique angle so that the bicycle frame or other work inclines away from the burner. The tank of this brazer holds 10 gallons. While intended specially for burning kerosene it can be used for either kerosene or gasoline. It is adapted to quite a general line of forging as well as rivet heating, bridge and railroad work and special places which will readily suggest themselves to the practical mechanic.

Lamp Inspector's Indicating Wattmeter.

The successful operation of an incandescent-lighting system depends largely upon the use of lamps of proper efficiency. To secure the most satisfactory service and highest economy, the efficiency of the lamps should be as high as the fluctuation of voltage on the circuits will permit. The selection of lamps for a particular installation should, therefore, be made with regard to the regulation obtained with the transformers in use. Efficiency is also the true basis for renewal of lamps, for it is manifestly uneconomical to continue a lamp in service when it has so deteriorated that the current it unnecessarily consumes costs more than a new lamp. A portable instrument to determine accurately and rapidly the watts per candle power required by a lamp is of great value in selecting new lamps and in testing lamps in service. The General Electric company has recently designed and introduced the Thomson inclined-coil portable indicating wattmeter for service of this class. The present design was adopted after numerous experiments to determine the most advantageous arrangement to facilitate rapid testing of lamps without inconvenience to their users. On account of the rapidity with which readings may be made, the indicating wattmeter will also be found invaluable for testing lamps in barrel lots either with or without a photometer. The wattmeter will accurately indicate the energy used by small fan motors and is, therefore, particularly useful in comparing, for a customer's benefit, the relative amount of energy required by a fan motor and an ordinary incandescent lamp. By supplying the secondary of a transformer with current, its core loss may be easily determined by the indicating wattmeter.

For rapid connection the wattmeter is supplied

KEYSTONE ARC LIGHT VOLTMETER AND GROUND DETECTOR.

with two special plugs, an Edison with T-H adapter, and a Westinghouse, thus providing ready means for connection to the three forms of sockets most generally in use. The lamp to be tested is inserted in one of the receptacles in the base of the instrument, and the proper plug placed in any convenient socket. Lead wires are provided suitably tipped at one end for insertion in the plugs and at the other for connection to the binding-posts of the instrument. A small secondary plug arranged to fit the regular plugs and provided with two small binding-posts is also supplied with every instrument. With this convenient device the power required by small motors or other apparatus may be conveniently measured.

The capacity of the indicating wattmeter is 150 watts. Lamps of any candle power up to 32 and of any voltage up to 150 may be tested, as may also any device, the consumption of energy in which is not over 150 watts at any voltage not exceeding 150.

The fact that the instrument is equally well adapted for use on either direct or alternating currents necessitates the use of only one instrument in stations using both systems.

On direct-current circuits reverse readings should be taken to eliminate the possibility of any slight error which may be introduced in all instruments of this class by the presence of local fields. A special reversing button is provided to reverse the current in the instrument and lamp without permitting the needle to fall back to zero. The usual convenience of reversing lead terminals is eliminated by the reversing button. When reversed readings are taken, the mean of the two is, of course, taken as the final reading.

Another advantageous feature of the instrument is the damping device. A button is provided which releases the needle or pointer from the damping brake only when depressed. When the button is released the needle is held at the point of the last indication; therefore, if the current is turned off and then on again, or reversed, the necessity of waiting for the pointer to swing from zero to a state of rest is avoided and very rapid readings may be taken.

The terminals, reversing and damping buttons

are mounted on a vulcanite baseboard, above which the graduated dial slightly projects.

The instrument is mounted in a finely polished carrying case, with snap lock. It is light and compact, the external dimensions being 7⅜ inches by 7 inches by 4½ inches. All parts are finished in polished nickel plate.

Injunction Granted on Van Depoele Patent.

Judge Lacombe handed down the following decision and opinion on February 7th in the United States Circuit Court for the Southern District of New York in the case of the Thomson-Houston Electric company against the Union Railway company, upon motion for preliminary injunction under claims two and four of the Van Depoele patent No. 495,443:

"The circumstance that these two claims were not expressly declared upon in the Winchester avenue case decided by Judge Townsend (71 F. R. 192) is not controlling. In Westinghouse Air Brake company against New York Air Brake company (65 F. R.) a preliminary injunction was granted by this court on patent No. 360,070, although it had not been previously adjudicated, on the ground that in the earlier litigation it had been 'discussed at great length and its meritoriousness clearly recognized.' And that injunction was sustained in the Court of Appeals (69 F. R. 715).

"It is perfectly plain, from an examination of the opinion of Judge Townsend and the voluminous record upon which it is based, that the very combination covered by claims two and four, viz., the overhead conductor and the trailing arm hinged and pivoted to the car, so as to bridge the space between it and the conductor, with a contact device at its upper end capable of being pressed upwardly into engagement with the conductor, was fully considered by him and held to be a most meritorious invention, and Van Depoele its inventor. It is thought that the decision of the Court of Appeals in this circuit in the Hoosick Railway case (82 F. R. 46) has not affected the weight of the Winchester avenue decision so far as it deals with the questions of invention and priority. The Court of Appeals held that claims 6, 7, 8, 12 and 16 of the patent here sued on were invalid because the particular combination or combinations which those claims covered had been already patented by Van Depoele in his earlier patent No. 424,695. And this was all that it held. The complainant therefore comes into this court with the presumption arising from those judicial conclusions in the Winchester avenue case, which the Court of Appeals did not disturb.

"The two claims now declared on are as follows:

"2. The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm carried by the car and carrying the contact device, and pivoted so as to swing freely around a vertical axis.

"4. The combination of a car, an overhead conductor above the car, a contract device making underneath contact with the conductor, and an arm on the car movable on both a vertical and a transverse axis and carrying the contact device.

"In the Hoosick railway case double patenting was found because each of the claims therein considered contained in some form of words a reference to a 'spring' or 'weight' or 'weighted spring' or 'torsion spring' or 'spring device,' one of whose two functions was to centralize the depressed end of the trolley, and the other was to give the upward pressure to the contact end.

"The two claims quoted contain no words which can be tortured into any such reference. Manifestly they were intended to cover and do cover only the combination of the car and conductor, with an underrunning trolley capable of swinging freely on a vertical axis, and thus adapted to curves and irregularities in the conductor. And Judge Townsend held that Van Depoele was the first to make practicable the electrical propulsion of an electric railway by 'a long, rigid arm upwardly pressed and capable of universal movement.' The defendant contends that the weighted spring, which is the only means for imparting upward pressure disclosed in the patent, must be read into these claims, for the reason that without it the claims would cover 'inoperative and useless' combinations. It seems unnecessary to discuss the authorities cited by complainant in opposition to this contention (Deering vs. Winona Harvester company, 155 U. S 286, Taylor vs. Sawyer, 75 F. R. 301; Halloway vs. Dow, 54 F R 511) Although an additional device may have to be added to make the combination operative automatically, it is none the less operative without such addition. A boy seated on the roof of the car would impart the upward pressure, not as economically nor as well as the weighted spring would, but quite sufficiently to insure the operation of the combination expressed in the claim.

"It must be concluded, then, that claims two and four do not cover a spring or weight or torsion device, and it is conceded that they contain no switching device. In the earlier patent no claim is to be found which does not contain either the spring or weight or the switching device. It would seem, then, that these claims certainly are not obnoxious to the criticism of the Court of Appeals and that no 'double patenting' is shown. And since the meritoriousness of the invention and Van Depoele's priority was found by Judge Townsend in the Winchester avenue case, complainant should be entitled to hold what it has established after long and expensive litigation, unless the case presented here is changed by evidence not before the court in that case. I cannot see that the Hunter and Deligny patents, which are only new ones, are any more of an anticipation than were those introduced in the Winchester avenue case.

"It is further contended that complainant has unreasonably neglected and delayed to enter a disclaimer of claims 6, 7, 8, 12 and 16 of the patent in suit, which were held void by the Court of Appeals. That decision, however, was rendered upon an appeal from an order, and complainant is naturally averse to finally relinquishing these claims until it may have had an opportunity to apply to the Supreme Court for a certiorari, an application which it is useless for it to make when only a preliminary order is involved. There seems to be good ground for delaying disclaimer.

"The argument that by its disclaimer of claim nine complainant has disclaimed the entire invention of the patent, which is, therefore, wholly void, is unfortified by authority and unpersuasive.

"Infringement cannot be seriously disputed. Defendant's device is practically a duplication of that used by Van Depoele in New Orleans in 1885. Complainant may take order for injunction pendente lite, but when issued its operation may be stayed for 30 days to give defendant an opportunity to review this decision at this term of the Court of Appeals."

Completing the Postal Company's Marine Cable System.

On Saturday, January 29th, a cable was laid from Sandy Hook to the mainland, thereby completing the system for marine service which the Postal Telegraph-cable company has been establishing. On the day previous a party of gentlemen, including Captain W. L. Candee and George T. Manson of the Okonite company, E. G. Cochrane, general superintendent of construction for the eastern division of the Postal company, and George W. Blanchard, assistant superintendent for the same company, visited a summer hotel just below the Twin Lights of the Highlands of Navesink and spent the night there, as it was planned to have Captain Scott of the Wrecker rom New London, with his trained crew, in charge of a sea-going tug and wrecking scow carrying the cable, to reach the spot for laying early in the morning, where he would be joined by the party. The night was stormy and the morning broke with skies leaden and lowering, and a piercing wind blowing. The party was carried by a locomotive to the point of Sandy Hook, and on the arrival of Captain Scott's flotilla was embarked in lifeboats.

The end of the cable was carried ashore at a point about half-way down, or shortly beyond the spot where the ocean has broken across Sandy Hook, thus changing it into an island. Connections were then made at the terminal pole and the trench running up the short beach containing the cable was filled in. Because of the shallowness of the water it was not possible to use the tug, and the huge scow carrying the cable was compelled, by means of its own engine and while attached to anchors carried to the opposite shore, to "lift itself by its boot-straps."

The method of laying the cable was unique. Instead of running it off reels, it was coiled in a circle on the deck, the end being paid out by passing through a block raised high in the air, then descending to the stern, passing through a brake made of wood so as not to injure the strands. As the scow moved slowly forward by means of its own engine connected to the anchor on the shore, the cable dropped evenly to the bottom.

When the strip of land which juts into the Horseshoe with water on either side was reached, a bight of the cable was taken ashore, and, by using a strong rope connected to the engine, was hauled across the land to be taken up again on the other side by the scow and carried through he remaining water.

The length of the cable laid was about one mile in a straight line and was one of the standard marine forms made by the Okonite company of New York, of which so many have been laid of late years. The total weight was about 10 tons, or four pounds to the foot. This link gives the Postal company direct cable connection from Coney Island across to Sandy Hook and from Sandy Hook to the Highlands, also the alternative connection from Fire Island across Brooklyn to New York and from Coney Island through New York Bay to New York city.

By a vote of the stockholders the Hastonville, Mantua and Fairmount passenger railroad was leased for 999 years to the Union Traction company, Philadelphia, January 27th, at a rental of six per cent. on $500,000 preferred stock and four per cent. on $2,000,000 common stock. The effort to prevent the lease by a legal injunction failed. The Hastonville property, with its leased connections, was the only line of surface railway operated as a competitor of the street-car consolidation in Philadelphia. The entire street-railway system is now under one management.

Electric Lighting for Profit.[1]

By Alex Dow.

I submit as the first proposition that we are all in business to make a profit. I don't expect to be contradicted on that proposition, although some may wish to so amend it as to indicate that they are at present content if they can avoid a loss. As a second proposition I submit that the conditions of the electric light industry have so changed in the last few years that the opportunities of profit are limited, that the margin between earnings and expenses tends to vanish and can only be kept in view by unceasing endeavors to increase the one and reduce the other. The days have departed when a neat dividend could be paid on a small business done at high prices, and now if a dividend is to be paid at all it must be earned by doing all the business that can be obtained and at prices set but little above the actual cost of production. As the preceding statement forms the text of this discourse, I ask your attention to its repetition, as follows: I believe that the proper policy of electric light management under the conditions of the present time, is to sell electric energy to every accessible user, in any shape that the user requires and at the lowest price which will pay a reasonable profit on the capital invested.

A New Policy for New Times.

Those of you who were in the business at its beginning will recognize in this profession of faith the converse of the rule which then governed us. We used to believe in a "system," and the people who taught us so to believe charged us so much for the experience, and the incidental machinery which we acquired, that we in turn had to collect great prices for the product sold to our customers. The rule was to get out of the business all that it would stand, and if a possible customer did not like the particular kind of energy which our "system" furnished and thought he would like the kind which some other alleged system was supposed to produce, we considered him a heretic. Electric light was then a novelty and a luxury and a mystery, and was to be respected and paid for accordingly. Nowadays, it is a thing of domestic use, the machinery for its production is sold as freely as any other machinery, the principles governing its distribution are taught to all who desire to learn and its supply is recognized as a customary or even necessary public service, exactly as is the supply of gas and water. It is proper that we should announce a policy suited to the new condition. That many have done so I know, and also that some have long been governed by just such a policy as I advocate, but there still remain, to the detriment of the business at large, some who are trying to run their affairs on the old plan. They do not profess to do so, and if challenged they may plead the old excuse —that the cost of their plant and the losses incident to its first operation have been so great as to require high prices for the energy sold. That excuse is not valid in these latter days. Taxing customers all they will stand means competition either by an opposition plant or by the municipality, and either of these means ruin to the station which is run on the old lines.

Of course I do not intimate that any member of this association is managing his business to-day after the fashion of the '80's. But each of us knows of some plant in the next town to ours which is run just that way. That plant is going to fight it out on the old line until it is wiped out by a municipal plant, and the municipal plant will publish a report to the whole United States that it has reduced the price of lighting 30 or 40 per cent. Then you and I and each of us are going to have the trouble of explaining at great length to our own particular municipal authorities why a municipal plant established in our town cannot possibly make any similar reduction.

Gentlemen, the man who used to sell experience to us is probably to-day trying to show the ambitious city fathers of that other town next to ours how well they can serve their constituents and how much honor they can obtain from society at large by engaging their municipality in the electric lighting business. Our friend with experience to sell is not one bit more exact in his statements than he used to be long ago, and we cannot honestly say that his operations are beneficial to our business; but he is less detrimental than the man who gives him a chance to get in his work, the man who ought to be giving good service to a satisfied constituency, but who is furnishing lights that are a disgrace to the "system" and its owner and trying to collect higher rates than those at which you and I are giving first-class service to our public.

What Is a Reasonable Profit?

This is a much-discussed question. The man in the next town believes that a reasonable profit is everything he can get, and at the other extremity of belief is the man who holds that no public service should pay a profit to any individual. Between these limits will be found the opinions of the great majority of Americans whose democratic training has taught them that the commonwealth should not undertake any work which can be satisfactorily performed by private enterprise. Those members of this great majority, who have money invested in

1. Read before the Northwestern Electrical association, Milwaukee, Wis., January 19, 1898.

manufacturing or in commerce, recognize that a reasonable profit means something more than can be obtained by the investment of their funds in government bonds or by placing them in a savings bank, and yet something less than is hoped for when the investment is of a speculative character, involving risk of total loss of capital, such as the exploiting of a new mine or the insurance of an overdue vessel and its cargo.

I believe that after operating expenses are paid and any deterioration of the investment shown by a careful inventory has been made good, a dividend such as is paid by a good manufacturing business is reasonable for electric lighting. Such a dividend will necessarily vary with the line of manufacture; those concerns who manufacture a staple having a practically constant market being satisfied with a narrower margin of profit than those others where the production has to be varied from time to time and new markets developed at intervals. The same considerations govern in the electric lighting business. A station which is well established, has no ruinous competition to meet, is not threatened by municipal interference, and is not obliged to continually risk money in extensions of an uncertain character, may well pay a dividend but little in excess of the current rate of interest in savings banks. The station in which all these conditions are reversed, particularly when there is a prospect of the investment being wiped out by causes which its management cannot control, is entitled to a greater return.

There is much work to be done in the education of the public to a proper understanding of the economical principles underlying this subject. The citizen who has theories about municipal service does not apply these to his own affairs, nor will he apply to his theories the rules which govern his personal practice until you show him that this should be done. He thinks it no harm that he should draw from the capital invested in his own business 10 or 15 or 20 per cent. in addition to a fair salary for management and any loss that is shown by annual inventory. He thinks it entirely proper that he should build up a business worth much more than its nominal capital, by returning into it a large annual surplus, but he will denounce as extortionate an electric lighting company which pays a good deal less than 10 per cent., and for such a company to show a surplus is, in his eyes, prima facie evidence of robbery of the public. He, on the one hand, refuses to protect the public-service corporation from unlimited competition, and, on the other hand, demands that it do business for a rate of profit accepted only on the safest class of investment bonds.

In Europe they are more logical. They limit the price which a company may charge to its customers and the dividend which it may pay to its stockholders. They require the company to give good service to all who demand it within a certain area. But at the same time they permit no competitor to enter the same district and they provide for the purchase of the property at a reasonable price in the event of the franchise not being renewed at the expiration of its term. Where they restrict they also protect. Our theorists have yet to learn that these two actions should go together, and it seems to be our affair to teach them this lesson.

How Shall Rates Be Made?

There has been of late much discussion of this subject at conventions and in the electrical press, and with good reason. American practice has heretofore been to make rates without sufficient analysis of cost, and particularly without attempting to make each unit of energy sold bear its proper share of the standing charges of the plant. Premising that we are to readjust rates for a minimum profit, we must do so according to a carefully considered system. It will not do to make a horizontal cut on the present schedules, because analysis will show that some business now done at the highest rate is not profitable, and a reduction of rate should only be made on business that is profitable.

It has been said that American customers insist on a uniform rate—a "one price American plan" method of charging. I do not find it so. I have no difficulty in explaining to the customers whom I meet why some business should pay a higher rate than other business, and other electric light men tell me that as soon as they have got the principles involved clearly defined in their own minds their experience with customers is similar to mine.

The basis of any system of ratemaking must be analysis of the cost of production. The method of analysis which I have found most useful is that proposed by Mr. Arthur Wright. The paper read by that gentleman at the last meeting of the National Electric Light association [illegible] familiar to you, but as American conditions usually differ from those existing at Brighton, it [illegible] possible to apply the best method of [illegible] standing and running [illegible] which Mr. Wright found convenient, and [illegible] in detail must be made. I use the following method: Consider what the condition of the station would be if you were obliged to be ready to do the [illegible] business that you now do, and during the [illegible] taking current [illegible] on duty, dynamos [illegible] lines [illegible] connections made to customers' premises [illegible] would burn enough coal to keep [illegible] the dynamos in motion, and you would [illegible] help for these conditions. [illegible] so much coal as if the machinery were running at full load, and you might need less help. Your lines would be out in the weather or buried in the ground, and that deterioration which is due to time and to climate would go on just the same and would have to be made good by a repair gang. But you would not need renewals of incandescent lamps or carbons and you would not keep any men to put in fuses for customers or to read meters. You would need a manager and an engineer and an electrician just as you do now, but you would not need a bill clerk nor a collector, and you might do without an office boy. My rule is to ask whether the item of expense under consideration would continue or would cease under the conditions described. If it would continue it is a standing charge. If it would cease it is a running charge. It is clear that taxes, insurance and interest are standing charges.

Mr. Wright has shown us that it costs us a great deal of money to get ready to serve a customer, even though the customer only requires service for a single hour in a year. This amount he calls the standing charge. He has pointed out that a uniform rate takes no account of this, but is apparently based on the assumption that it costs just the same to furnish current to a customer for one hour in the year as for each hour of one thousand hours in a year. He argues correctly that in making rates we should take account of a customer's load factor, and he goes on to describe an ingenious method and an ingenious device invented by himself for taking such account. Whether we adopt his device or not, we must all admit the correctness of his statement of the conditions governing costs of production and we must, if we are hereafter to do business at a profit, make our rates with a due regard to these conditions.

To discuss in detail the whole theory and practice of ratemaking is beyond the scope of this paper. I advise each of you who has not already done so to make analysis of your costs in such manner as to distinguish between standing and running expenses. Using Mr. Wright's paper as a text-book, you will find, as I did, that the labor is well paid for by the results obtained. Properly tabulated, these results will show what business is profitable at any given rate or what rate should be made on any given business. My analysis showed me that I could afford to sell current to a large class of users at $4\frac{1}{2}$ cents per unit, while a rate already established at 14.4 cents for another large class was not profitable. Now I am taking all the $4\frac{1}{2}$-cent business I can find and am letting other people hunt for the 14.4-cent kind.

Classes of Business.

The immediate business of an electric lighting station is to supply incandescent and arc lighting and power for stationary motors. Some small plants limit their business to lighting, and thereby avoid operating during the daylight hours. I think that this is often done without good reason. There is nearly every village some demand for power, or such a demand can be developed by an enterprising manager. It is likely that the rates to be obtained for power will be very low, but if they will pay the additional cost of running the station during the daytime and also carry some proportion of the standing charges, these low rates may be profitable indirectly by reducing the amount of standing charges remaining to be earned by the lighting business. It is certain that interest, insurance and taxes run for 24 hours a day, although the plant may only operate for 12, and if the power load will pay half of these items, in addition to its actual runing cost, it is worth having.

Some stations do not run all night. The people in the village where such a station is located may go to bed early and may not use any appreciable amount of current after 11 o'clock or midnight. But I have always found it difficult to work up a good business in residence lighting unless the plant undertook to give all-night service. Apparently customers do not care to have a duplicate lighting equipment in their residences. They do not fully appreciate the beauty of incandescent lighting if it cannot be switched on at any moment when it is wanted. People sometimes want lights between midnight and morning in their houses, and I suppose will continue to do so as long as our children come into this world with unreasonable ideas as to the part of the day in which they should do their sleeping.

I am sometimes told that residence lighting is unprofitable. It surely is, if every residence that is served requires an independent transformer, and if only one residence in a dozen takes current at all. The only way to do residence lighting at a profit is to do all the lighting or nearly all that there is in a given residence district, and for this purpose the rate must be placed so that every possible customer can afford it. I have tried the experiment of low residence rates on a small scale more than once, and in each instance with success. It is to be tried now on a large scale in several stations, and I am certain that the experiment will be successful. The load factor of residence lighting is much better than the average load factor of many stations.

General Distribution System.

It is a serious handicap to a station when it is obliged to run two or three separate types of dynamos and to maintain two or three separate distributing systems for the supply of different kinds of energy. The best practice to-day is to furnish incandescent lights, arc lights and motor service from the same dynamos and same mains. This is a subject to be considered in the original plan of the station, but there are instances where old stations have been rearranged with decided financial advantage. When a power load can be had, even at the low rates already spoken of, a study of the local conditions should be made with a view to seeing whether a general distribution system will not be a source of profit. To design a new station without such a system is almost criminal.

Supply of Street-railway Current.

There has not yet been devised a satisfactory system whereby a supply of 500-volt current for railway work can be combined with a general lighting distribution. Therefore a proposal that a lighting station should furnish such current must be dealt with as involving a new investment. This investment is always the cost of dynamo and switchboard and usually the cost of an engine. The street railway evening load in winter-time coincides with the heaviest load on the lighting system for about 200 hours per annum. At all other hours the street-railway demand is a desirable addition to the load on the boilers, and in most stations the dynamo and switchboard can be cared for without cost for additional help. If the boilers are properly designed to suit the conditions, they may be driven beyond their usual rate during these 200 hours with greater profit than would be possible if additional boiler capacity had to be installed. Furnishing street-railway current appears, therefore, to be equivalent to the sale of steam to a special engine and the furnishing of attendants to an additional engine and dynamo; and it should be considered as a business proposition on that basis, and not in the same manner as a demand for current from the electric lighting plant.

Street Lighting Contracts.

If street lights can be served from a general distribution system, the rate should be made in the same manner as the rate for any other service from that system. As street lights usually run about 4,000 hours a year, a rate made on a scientific basis will be very low in comparison with the rate for ordinary commercial lighting. This is not in accordance with the old practice of making all the profit of the old business of a street lighting contract, but it is distinctly in accordance with the more modern practice which will probably become general.

Municipal contracts which can be performed without investment in special machinery are desirable business in that the payment is prompt and absolutely secure, and that the conditions of their performance are clearly laid down in the original agreement. For that reason the tendency appears to be to take such contracts at a very narrow margin of profit. But when the performance of a street lighting contract requires an investment in special machinery and the building of special lines, such a contract is usually undesirable business. It is impossible, under present conditions, to secure such prices for street lighting as will return the investment to the stockholders within the term of the contract. The contracts are usually short and there is no security of their renewal. If in dealing with a municipality one were dealing with a business corporation having an established policy, it would be justifiable to take such chances, but our American cities if they have a policy at all change it from election to election, and no contractor can tell that the service which was deemed perfect by the board with which he made his contract, will not be entirely unsatisfactory to its successor with whom he must make a new contract two or three years hence. In this respect we have another lot of educational work cut out for us. If we could make it clear to the mass of our citizens that the price for a year's street lighting depended on whether the street-lighting plant would be employed next year or would be standing idle, we might have some chance to make close bids, without feeling that we were engaged in a risky speculation. The peculiarly exasperating part of the whole subject is that those same theorists who object to asking for bids on a contract running more than two or three years, are usually ready to lock up the good money of the citizens in a city plant which has to be security for 30-year bonds.

Special Sources of Revenue.

In many localities there are opportunities whereby the power of a lighting plant may be employed in work which is not usually considered as part of the lighting business. An arrangement with a manufacturer whereby machinery required by the plant during evening hours will be used by the manufacturer in the daytime is often possible. A similar arrangement is made in many places for the joint use of a water power. The sale of exhaust steam for heating purposes is another source of revenue which is frequently neglected.

How Can Business Be Held When Once Obtained

In these days of competition this subject becomes of the greatest importance. We have against us in every station some competition. In the larger cities we have to meet the offers of opposition companies doing a similar business, the arguments of the man who wants to sell isolated electric plants to our best customers and the ever-present cheap service offered by the gas company. In the smaller towns

and villages the worst obstacle to the holding of business is the tendency of our customers to economize by cutting down the amount of light used. This tendency is present also in the large cities, but is not so constantly in evidence, because many city people must use light liberally in order to carry on their business. The whole law and gospel of holding business consists in getting your customers to believe that they receive good value for their money. It is not sufficient that you should believe it, you must convince the customers. But it tends to make your success more certain if you know in your own mind that you really are giving good value. For this reason it is essential that you know what each block of lighting costs, which brings up again the subject of analysis of expenses.

No matter how cheaply you offer to sell your products, it is essential that the customer is satisfied with what is delivered to him. Therefore if he wants to use arc lights you must see that they are quiet and steady. If he buys current from you wherewith to operate a motor, you must make it your business to see that his motor runs satisfactorily. It is not a part of your contract to do this, but if the motor does not run as it should you will go up there some day and find that he has bought a gas engine. If you sell him current for incandescent lighting, you must see that the lamps are renewed before they become dim. If you cannot get the customer to buy new lamps, you had better arrange to furnish renewals free, as most stations now do. If even then your customer is slow about calling for renewals, you had better send one of your men up to change the lamps. Neglect in this respect probably means that there will be a sale of Welsbach burners in the neighborhood of that customer. You must be prepared to send assistance to him when he mixes things so that fuses get blown, and you must send this assistance promptly. This may mean that a man has to idle around the station waiting for trouble calls, but you should not think that man's idleness gives you a chance to economize by discharging him. You should look upon it as the outward and visible sign that your customers are getting good service. And above all, you must take such precautions that your service may be relied upon by all who employ it. There is nothing that does so much to damage the business of a station as a reputation for unreliability.

Conclusion.

In closing I wish to say that I am preaching no doctrine which I do not believe, or which I do not try to follow. Neither do I imagine that the stations represented in this association are less carefully planned or less efficiently managed than those of the rest of creation, that I should address myself to you rather than to others. But it is by electric light men and no others that the advice must be given to those who need it. And each of us has the opportunity at some time to counsel with the man in the next town of whom we have been speaking. While I was in the act of preparing this paper I was asked for advice in just such a case and gave verbally just the same advice that I was putting in writing for presentation to you. This is a final summary of the opinions I have presented:

(1) The electric lighting business should pay a reasonable profit, approximately the same rate as any manufacturing business which has similar risks. This profit should be paid after the expenses of operation, maintenance and depreciation shown by annual inventory have been provided for.

(2) Rates for electric supply should be so adjusted that each unit sold will pay its share of operating and standing charges and in addition thereto a uniform proportion towards profit. No business should be done at a loss and no business should pay more towards profit than its proper share.

(3) Every class of business that can be profitably done should be obtained. Business that improves the load factor should be taken if it can be obtained at any price greater than its share of operating and standing charges, because the improvement of the load factor reduces the amount of standing charges to be borne by existing load.

(4) Business once obtained should be kept by careful study of and prompt attention to the requirements of each customer. It is not possible in the present stage of electric development for an American electricity-supply company to limit its interest in the supply to its delivery on the customer's premises. It must do much work in order to secure that the customer uses the supply to the best advantage. It is not sufficient that a customer should be well served; he must also be well pleased.

(5) There is need of educational work to be done among electric-light men, among municipal authorities and municipal theorists, and among our own customers. It is to our interest that this educational work should be done, and as it does not appear to be the duty of any other person to do the work, we will have to do it ourselves.

Representative Wheeler has introduced a bill in Congress asking for the sum of $35,000 for the erection of a building and its equipment as an institution of learning, the same to be known as the Morse Memorial Conservatory of Telegraphy, for the double purpose of teaching telegraphy and the perpetuation of the memory of Morse. The bill also carries with it a provision for one perpetual free scholarship, the fund for this to be obtained either through public or private contributions.

American Street Railway Association

T. C. Penington, secretary and treasurer of the American Street Railway association, has issued the following announcement:

The seventeenth annual meeting of this association will be held at the Massachusetts Charitable Mechanic Association Hall, Boston, Mass., September 6, 7, 8, 9, 1898. This early date was chosen by the executive committee as it was the only week until late in December that we could get the hall. Article 7 of the by-laws reads: "Special meetings may be held when ordered by the executive committee." This will be a special meeting, but will take the place of the regular one. We expect to have a very large, if not the largest, exhibit of railway appliances ever shown to this association. Our Boston friends are very enthusiastic, and promise to do all in their power to entertain us while in their city.

The headquarters of the association will be at the Hotel Brunswick. Hotel Vendome is managed by the same parties, and will be used in connection with the Brunswick.

Hotels and rates: Brunswick, American plan, $4 per day and up; Vendome, American plan, $4 per day and up; Copley Square, European plan, $2 per day and up; Nottingham, European, $2 per day and up; Victoria, European plan, $2 per day and up; Turaine, European plan, $2 per day and up; Parker, European plan, $2 per day and up; Young's, European plan, $2 per day and up; Thorndyke, European plan, $2 per day and up.

The first five mentioned are within five minutes' walk of the hall; the others are downtown, with street cars to the door of the hall. The executive committee advises all who desire rooms to apply at once, as the rooms at the Brunswick and Vendome are limited, but no rooms will be assigned until March 15th and will be assigned in the order in which applications are received. Railroad rates will, in all probability, be as before—one and one-third fare for the round trip, due notice of which will be mailed you in time. Papers will be read on the following subjects: "Maintenance and Equipment of Electric Cars for Street Railways;" "To What Extent Should Street Railway Companies Engage in the Amusement Business;" "Underground Electric Roads—Construction and Management;" "Carrying of United States Mail on Street Railways;" "Comparative Earnings and Economy of Operation between Single and Double Truck Cars for City Use;" "How to Care for Return Current;" "Inspection and Testing of Motors and Car Equipment by Street Railway Companies."

The annual dinner will be held at Hotel Brunswick, Thursday evening, September 8th.

CORRESPONDENCE.

New York Notes.

New York, February 9.—A source of constant annoyance to the Metropolitan company since the conduit trolley system was introduced has been the practice of small boys dropping pieces of metal in the slot in the hope of short-circuiting the system. According to a local contemporary, "a small boy was seen the other day poking a tin toy sword down into the slot. Presently he succeeded in bending the end of the sword so that it made a connection from one current-bearing rail below to the other, and then there came a snapping and crackling, accompanied by a great flash of colored light. Part of the current ran up the sword and gave the boy's arm a wrench. He dropped the sword with a yell and went scudding away with a scared expression on his face. Other boys have taking to dropping bits of wire into the slot. When a piece of wire falls so that it touches both electric rails at the same time there is a great flash of light as the current darts across the wire from one rail to the other. When such a thing happens, a man in the power house knows it at once, for at that moment one of the automatic ircuit breakers which he watches pops out with a bang, and if it is at night the lights on the cars go out. The watcher pops the circuit breaker back and everything is all right again."

In addition to the exhibit which will be made by the Walker company of Cleveland, Prof. S. H. Short, its electrical engineer, will make a personal exhibit at the New York electrical exhibition. For 15 years Prof. Short has been actively engaged in railway design and invention, and as far back as 1885 organized a company in Denver which laid and operated a slotted conduit railway. His work will now be interestingly and richly illustrated by pictures, relics, models, old apparatus, etc., and will constitute one of the features of the show that will attract wide attention and help secure for Prof. Short the recognition which certainly is his due.

Mr. F. S. Pearson, the chief engineer of the Metropolitan Street Railway company, is going to travel in Europe for a year. His reputation as an electrical engineer is well established, both in this country and in England, and on the evening of Wednesday of last week he was the guest of honor at a dinner given at Delmonico's by the engineering staff of the Metropolitan company. Mr. Pearson was presented a loving cup, a gold watch and chain and a diamond watch charm. Nearly two hundred guests were present, including gentlemen from Philadelphia, Boston, Syracuse, Montreal and Halifax, and a delegation of Mr. Pearson's old associates in the West End Street Railway company of Boston. Henry D. Macdona was the toastmaster, and the toasts and the speakers were: "A Present from the President," H. H. Vreeland; "Nuggets from New York," John D. Crimmins; "Statistics from Staten Island," Colonel G. B. M. Harvey; "Coals from Canada," W. L. Elkins, Jr.; "Beans from Boston," L. J. Hirt, and "Something from Everywhere," W. H. Knight. There were also remarks by William C. Whitney, the Rev. M. St. C. Wright and others. Mr. Pearson has had much to do with developing the underground trolley system in this city, and has also had much experience in the building of overhead trolley lines. He is consulting engineer for about twenty companies, including some in European cities.

A meeting was held last week, at the office of William C. Whitney, of the stockholders of the Erie Canal Traction company, which has the exclusive right to equip the canals of the state with a system of electrical propulsion, and the following directors were elected: Baron Louis A. von Hoffman, William G. Oakman, Richard S. Hayes, George G. Haven, Thomas C. Platt, Frank W. Hawley, Alfred S. Heidelbach, Commodore P. Vedder and Charlton T. Lewis. Baron von Hoffman was elected president, Mr. Hawley vice-president, and Mr. Lewis secretary and treasurer. All the directors excepting Senator Platt were at the meeting. The Walker company submitted a plan for a system of electrical canal-boat propulsion, which is understood to be looked upon favorably.

During the storm last week ice that drifted out of the harbor on the ebb tide ran afoul of the electric buoys in Gedney's Channel and extinguished the lights. Several of the buoys in the neighborhood of the Hook were carried out of position by the ice-crested tide. A steamer of the lighthouse department picked up the buoys and anchored them in their places.

Electric lights have been substituted for the dingy old oil lamps which formerly served to half light the Fourth avenue tunnel. S. A. M.

Western New York.

Niagara Falls, N. Y., February 7.—The taxpayers of Tonawanda are considering the advisability of establishing an electric light plant of their own and connecting it with the Niagara-Buffalo transmission line for operation. By connecting it with the Niagara-Buffalo power line they would need motors instead of steam engines, and the principle of operation would be very similar to that employed in the Buffalo and Niagara Falls Electric Light and Power company's plant at the Falls.

The Board of Trustees of the village of Tonawanda has taken hold of street railway matters with an iron hand. It has notified the Buffalo, Kenmore and Tonawanda Electric Railroad company that it is $7,200 in arrears on taxes, and that this must be paid or the franchise will be annulled.

It is understood that Lockport will again move in the matter of municipal ownership of a lighting plant, as Mayor Peterson allowed a resolution to stand which makes possible the introduction of the necessary bill in the Legislature this winter.

The Niagara Electrical company of Niagara Falls has secured the contract for installing a lighting plant for the village of Dundee, N. Y.

The promoters of the Penn Yan and Pennsylvania railroad have decided not to use the trolley system in operating their line. Engines equipped with gasoline motors and electric dynamos are to be used. The road will be connected with the Fall Brook line in Penn Yan at the foot of the lake.

An effort is being made to construct an electric road between Mt. Morris and Rochester, the line to be laid in the highway touching Avon and Geneseo. It is estimated that between 13,000 and 15,000 people would become patrons of the road.

It is the intention of the Buffalo General Electric company to use Niagara power for lighting purposes in Buffalo, and, with this object in view, it has awarded a contract to the General Electric company of Schenectady for 11 new step-down transformers. These transformers will have a combined capacity of 2,700 kilowatts, or about 4,000 horse power. They will receive current at a voltage of 11,000 and reduce it for use for lighting purposes.

The Common Council of Lockport, N. Y., has received a proposition from the Niagara, Lockport and Ontario Power company to furnish 15,000,000 gallons of water daily from a power canal for $50,000 a year. The city is authorized to pay this amount for a water supply by special act of Legislature. The charter of the power company was obtained by the Business Men's association, which is now defunct. No decision was reached, but the proposition is under consideration.

Thomas McCarthy of Seneca Falls has brought action against the Light and Power company of that village for $200 damages to his son by a live wire. The boy had climbed to the top of a 10-foot fence surrounding the ball-grounds of Cayuga Lake Park, and in getting over the fence he caught hold of a live wire and was severely burned. Several new questions are involved, and the case is attracting much attention.

At a recent meeting of the directors of the Niagara

Falls Power company two new leases of power and land were authorized. This means that two more manufacturing plants are to locate at the Falls. One of them is said to be a carpet and lace works, to be established by Alexander Morton & Co. This company has English, Canadian and American connections, and its new Niagara plant is expected to employ from 300 to 400 hands, principally women, in the lace department.

The Canadian Niagara Power company has caused the following notice to be published in the Toronto papers: "The Canadian Niagara Power company invites applications for the use of 5,000 electrical horse power within four miles of the railway power house in the Queen Victoria Niagara Falls Park; 300 horse power as direct current is available immediately, 1,000 horse power as alternating current will be ready for delivery May 1, 1898." In this connection it may be stated that Premier Hardy of the Province of Ontario has written to Mayor Hill of Niagara Falls, Ont., stating that the government will not allow the Canadian Niagara Power company any extension of time in which to commence or complete its power installation in Victoria Park. Under the franchise the power company must have 10,000 horse power available by November 1, 1898, and also have water connections made for the development of 25,000.

O. E. D.

Northwestern Notations.

Minneapolis, February 8.—An electric light plant is being discussed at Thorp, Wis.

The council of Hammond, Wis., granted a franchise to Frank P. Crocker for electric lighting, and at the next meeting rescinded it.

The Fox River Valley Inter-urban Railway company will erect a large power house on Doty Island, at Neenah, Wis.

The Fox River Electric Street Railway company of Green Bay, Wis., has been placed in the hands of a receiver. For the last two years the company has been making many improvements and extensions and has been obliged to use its current income to pay for them. It consequently was unable to meet its interest payments. The road was built in 1894 and cost $225,000.

B. F. Gray is arranging to put in an electric light plant at Hitchcock, S. D.

Both Grand Rapids and Centralia, Wis., have canceled their lighting contracts. The five-year contracts with the Central Electric company expired last fall, and each city refused to enter into another long-time contract, but offered to purchase service from month to month. Centralia had been paying $55 per light and Grand Rapids $65, but the company refused to furnish service by the month for less than $72 and on the moonlight schedule. This was refused and the lights have been turned off.

Business men of Miller, S. D., are talking of an electric light system.

The Citizens' Traction company of Oshkosh, Wis., is arranging for a three-mile extension of its line to a new park.

Linemen who were stretching a wire across Hennepin avenue, Minneapolis, from one building to another, dropped it to the trolley wire of the street railway, and the result made things lively for a few minutes. The trolley wire broke and dropped, striking a heavy draft-horse, and the current knocked it down. Street-railway traffic was interrupted for a short time, but, aside from this, no further damage was done.

The city of Centerville, Ia., is in a turmoil. In 1890 a local lighting company was formed and a plant put in. This finally got into control of outsiders who took all the income and made no improvements on the plant, but rather allowed the service to deteriorate. Citizens grew tired of it, and recently some leading local capitalists were invited to make an offer for electric street lighting. An ordinance was introduced in the council to grant the new firm a franchise and it reached the third reading, when the old company took a hand. The ordinance was voted down. The old company was granted a 12 year contract at $3,774, although the new company offered the same service at considerably less. The proposition was accepted and given three readings and passed, all within two hours. The people are up in arms about it. The mayor will veto, but the council can pass it over the veto unless some of the aldermen experience a change of heart.

A communication has been presented to the City Council of Waterloo, Ia., stating that the trolley-car lines are affecting water and gas pipes with electrolysis. A section of pipe which, six feet underground, had passed under the rails, accompanied the letter. It was perforated like a sieve. The communication was referred to a committee, which will confer with the street railway company as to the best manner of avoiding this.

C.

PERSONAL.

George A. McKinlock, president of the Central Electric company, is in New York this week.

Max Osterberg has been engaged by the Electrical Exhibition company of New York as construction engineer.

H. C. Thomson of the Electric Gas Lighting company of Boston was elected manager of that corporation at the annual meeting of the company.

O. P. Sells, formerly of New Orleans, is now engaged in electrical and mechanical engineering work in New York. Mr. Sells left New Orleans during the "fever scare" and found the outlook in New York so much better that he determined to remain for a time at least in that city. At present Mr. Sells is rebuilding the electric plant in the Windsor.

ELECTRIC LIGHTING.

The War Department, through the United States engineer at New London, Conn., is inviting sealed proposals until March 3d for an electric lighting and power installation at Great Gull Island, N. Y. Specifications and full information regarding the work will be furnished intending bidders upon application to Major Smith S. Leach, New London, Conn.

Favorable reports are at hand from manufacturing and illuminating companies indicating a waning in the popularity of the Welsbach burner. Customers are returning to the incandescent lamp, tired of the expense involved in renewing shattered mantles and worn out with the ghastliness of the light. Additional proof is furnished by the production and sales reports of the different manufacturing companies, which show a constantly increasing demand for incandescent lamps, as well as for arc lamps, especially those of the enclosed arc type. In stores, restaurants, cafes, hotels and halls, where the Welsbach burner secured temporary success, the enclosed arc lamp is rapidly bringing back the use of electricity, while in new establishments the Welsbach burner is not finding much foothold.

ELECTRIC RAILWAYS.

A receiver was appointed at La Porte, Ind., February 3d, for the Michigan City Street Railway company, which is owned by Russell Harrison. The liabilities are estimated at $40,000. No statement was made as to the assets.

The Maryland and Washington Railroad company in its annual report to Congress, through its receiver, says its paid-up capital amounts to $20,000. No dividends were paid during the year. The funded debt is $430,000.

At the annual meeting of the Englewood and Chicago Electric Railway company, February 7th, that company ceased to exist in name. The master's deed of the property was turned over to the Chicago Electric Traction company, the new corporation recently formed by the Englewood and Chicago reorganization committee, which purchased the latter road at the master's sale. Officers of the Chicago Electric Traction company were elected as follows: President, Jules S. Bache; vice-president, Samuel R. Shipley; treasurer, Henry Lewis; secretary, H. A. Hinsley.

The consolidation of all the trolley roads of New Jersey under the name of the Union Traction company is anticipated. The last step taken was the cessation of hostilities between the New York and Philadelphia and the Brunswick traction companies. These two companies have been at loggerheads for some time over securing a right of way through the town of Bound Brook. Another gap in through lines recently filled was at Millburn, through which the North Jersey company has at last secured a right of way. Franchises are now held by the various companies for through lines between New York, Greenwood Lake, Easton and Philadelphia.

The suburban trains of the Chicago, Milwaukee and St. Paul Railroad company will soon be operated by electricity instead of steam engines. President Louderback of the Lake Street Elevated Railroad company gave testimony to this effect while on the witness stand in a recent lawsuit. Mr. Louderback confirmed the announcement later, stating that contracts for furnishing electric power had been entered into with the North and West Chicago Street Railroad companies. He stated that the necessary ordinances had not yet been secured, and for that reason he declined to make public any of the terms of the contract. It was recently rumored that the Milwaukee company sought a franchise to substitute electricity for steam on its line between Chicago and Evanston, but it now appears that franchises are wanted for all the company's suburban lines running out of Chicago.

Articles of incorporation have been filed by the Los Angeles-Pacific Railway company. The company is formed for the purpose of consolidating the capital stock, debts, property, assets and franchises of the two corporations known as the Pasadena and Pacific Railway company of Arizona, and the Pasadena and Pacific Railway company of California to build and operate railroad lines between Los Angeles and Santa Monica, with branch lines running to Hollywood, Laurel Canon, South Santa Monica, Santa Monica Canon, and the Soldiers' Home. It is also the purpose to build telegraph and telephone lines along the main road and branches. The estimated length of all of the roads is 100 miles. There are 13 stockholders, each subscribing to five shares. The names are as follows: E. P. Clark, J. H. Spires, William D. Larrabee, Warren Gillelen, R. F. Jones, A. I. Smith, Milton E. Hammond, T. C. Paxton, M. H. Sherman, J. M. Copes, B. W. Pratt, W. C. Durgin and John D. Pope, all of whom are to act as directors for the first year. William M. Buffum, as trustee, subscribes to 9,935 shares. The amount of capital stock is fixed at $1,000,000, $100,000 of which has been paid up, divided into shares of $100 each. The main business offices will be located in Los Angeles. This system of electric roads is now in operation with the exception of one or two small feeders. The proposed consolidation of securities is for the purpose of unifying the management and to make possible further extensions and improvements.

Edmund Saxton, the contractor who is now engaged in doing the street work in connection with the installation of the underground electric system on the Pennsylvania avenue and Fourteenth street lines of the Capital Traction company of Washington, D. C., is going over the lines of the Eckington and Soldiers' Home railway, for the purpose of making an estimate of the cost of putting the underground electric system on this line. He has been invited to do this by Mr. O. T. Crosby, who is a member of the syndicate that some months ago acquired the controlling interest in this road, as well as in other street railroads. Mr. Saxton will submit an estimate of the cost of the work, and it is thought that the installation of this system within the limits of the city, and the improvement of the overhead trolley section of the road, which extends beyond the city limits, will involve an expenditure of over $1,000,000. Mr. Crosby states that it is the intention of those now controlling this property to operate all the city lines of the road by the underground system. It is stated that this system will be installed as soon as the necessary legislation asked from Congress has been obtained. A bill is now pending providing for the consolidation of the Eckington and belt railroads and the Washington and Maryland (a portion of the boulevard line between Washington and Baltimore). When these properties are united it is the purpose of the owners to issue bonds secured by a mortgage on the entire property, and with the money thus secured to equip the city lines with the underground system, and perfect that portion outside the city bounds which is to be operated by the overhead trolley.

TELEGRAPH.

The opening of a new cable line via Turks Island and Bermuda, giving the United States and Canada a competitive route for cablegrams to the West Indies, was celebrated on January 31st. The new cable connects with the service of the Commercial Cable and Postal Telegraph companies.

At the request of the secretary of state, the acting attorney-general has given an opinion on the question of the authority of the president, in the absence of legislation in the matter, to control the landing of foreign telegraphic cables. The question was raised by the action of the French Cable company, in landing a cable at Cape Cod without the express permission of Congress or the president. Mr. Richards' conclusions are as follows: That the president has the power, in the absence of legislative enactment, to control the landing of foreign submarine cables. He may either prevent the landing, if the rights entrusted to his care so demand, or permit it on conditions which will protect the interests of this government and its citizens; and if a landing has been effected without the consent or against the protest of this government, respect for its rights and compliance with its terms may be enforced by applying the prohibition to the operation of the line unless the necessary conditions are accepted and observed.

POWER TRANSMISSION.

A St. Petersburg company for the transmission of power from waterfalls has recently been organized in Russia to build plants for the utilization of the Narowa, Imatra and Wuozen waterfalls in the generation of electrical power, and to transmit and distribute it in St. Petersburg and surrounding districts for electric lighting and power purposes. The capital of the company is $2,000,000.

A development of water power for electrical transmission is contemplated by a company of New York and Pennsylvania capitalists, who have acquired control of the Chattahoochee River for 16 miles. The purpose is to build three plants and a stone dam at each of the places. The fall from Jones Shoal to Bull Sluice, a distance of 13 miles, is from 75 to 80 feet. This part of the river will be a continuous lake, broken only by one dam. It will vary in width from 500 feet to one mile. The three dams will furnish 11,000 horse power. The purpose is to furnish electrical power for machinery placed upon the Southern railway from Atlanta to Norcross for manufacturing purposes. The incorporators of the company are Henry B. Wilson and Emerson McMillin of New York, C. Emerson Smith of York, Pa., and R. H. Smith of Gainesville, Ga. It is announced that at least $1,000,000 will be invested in the enterprise.

ELECTRICAL SECURITIES.

The quarterly statement of the Staten Island Rapid Transit company shows net earnings of $81,973, with charges of $82,933, a deficit of $960. Last

year for the corresponding period the deficit was $33,805.

The Charlestown Gas and Electric company declared a semi-annual three per cent. dividend February 1st.

The Edison Electric Illuminating company of Boston reports gross earnings for the year 1897 of $879,949, an increase of $106,471. The net earnings were $339,828, an increase of $64,648.

The board of directors of the West Chicago Street Railroad company has declared a quarterly dividend of 1½ per cent. on its capital stock, payable February 15th. Transfer books closed February 5th and will reopen February 16th.

The Brooklyn Railroad company reports net earnings of $450,093.78 for the quarter ended December 31, 1897, as compared with $430,372.93 during the corresponding period of 1896. The balance sheet shows cash on hand $292,523.17.

An advance of 3¼ in General Electric during last week is noted. A financial authority offers this explanation: "The advance in General Electric is explained by the increasing demand for electrical appliances, particularly from transportation companies."

The Alexandria, Mount Vernon and Washington Railroad company reports a paid-up capital of $500,000, a funded debt of $700,000 and a floating debt of $19,682.12. The number of passengers carried in the District during the year was 924,145. No dividend was declared last year.

The capital stock of the Eckington and Soldiers' Home Railroad company is $652,000, of which $581,600 is paid up. No dividends were paid during 1897. The number of passengers carried during the year was 3,931,999. The expenditure for the year was $123,182.91, or $25,067.61 more than its receipts.

The Belt Line Railroad company of Washington reports $222,972 paid in on a stock of $500,000. Five thousand and three of the 10,000 shares of stock are held by the Central Trust company of New York. The total earnings of the year were $71,983.46; the expenses, $89,761.48, or an excess of $17,778.02.

The total gross earnings of the Brooklyn Rapid Transit company's system for the month of January were $414,809.66, an increase of $22,523.85 over the same month of 1897 and $32,366.99 over January, 1896. For seven months ended January 21st the gross earnings were $3,220,150.06, as compared with $3,129,565.62 for 1897 and $2,971,042.54 for 1896.

MISCELLANEOUS.

A new tariff went into effect in Tasmania on January 1st, and under its provisions electric light cables and insulators are subject to a duty of 10 per centum ad valorem.

The bill granting right of way to and construction of a railway, telegraph and telephone line through the Indian Territory to the Denison, Bonham and New Orleans Railroad company of Texas has been reported back to the Senate with some slight amendments.

The Vera Cruz, Mexico, custom house has been supplied with electricity from the town, and connected with the local telephone system. An electric plant has been ordered from England, with a searchlight of 12,000 candle power to illuminate the bay, and incandescent lamps for use in the government building.

A Detroit dispatch in a New York paper states that the entire product of the Champion iron mine of Champion, Mich., has been contracted for by a New York concern. The Champion is supplying solid slabs of magnetic iron ore which are being used to replace platinum as anodes in the collection of chlorine gas. The magnetic oxide slabs have been proved practically indestructible, and are better adapted for this use than any agent thus far discovered. Sixty tons have been exhausted in the experiments at New York. Heretofore Russia has furnished the magnetic oxide, but the Russian product is said to be inferior to the Michigan ore, and the expense of importation has greatly handicapped the chlorine-gas makers.

TRADE NEWS.

The Otto Electric company of New York announces that it has secured the American agency for the Cox thermo-electric generators.

Mr. F. H. Clark, manager of the Chicago office of the Electric Storage Battery company, has closed a contract with the Patten Motor company for four equipments of 100 cells each.

A booklet especially prepared "for guys" is the latest production in the way of a circular which is being distributed by the Leschen Macomber-Whyte company. It is said to have come of an inspiration received during Mr. Whyte's recent trip to foreign shores.

Royce & Marean of Washington, D. C., have just moved into new quarters at 1423 New York avenue, where they have one of the largest and best equipped stores for electrical supplies to be seen in the South. This change was necessitated by the growth of their business.

The Kokomo Telephone and Electric Manufacturing company of Kokomo, Ind., has just moved into its new home. The factory and offices occupy a building 30 by 100 feet, two stories high, of brick and stone, on the corner of Main street and Broadway, one of the finest locations in the city.

The number of arc lamps manufactured and shipped from the factories of the General Electric company within the last fiscal year exceeded 24,000. Many thousands of the G E enclosed arc lamps are now in service, and the introduction of the alternating enclosed lamp has still further increased the sales.

General Manager Herbert Lloyd of the Electric Storage Battery company of Philadelphia reports that the business of the last year was more than double that of 1896, and the prospective business is far in excess of that of any former period. This pleasant condition of affairs must be particularly pleasing to Mr. Lloyd, who has been such a tireless worker in promoting the interests of the company.

The Stromberg-Carlson Telephone Manufacturing company reports a steadily increasing demand for the inter-comunicating systems, as well as the public exchanges and toll-line apparatus which it makes. Among its recent orders for private-plant equipment is the fourth from the Pennsylvania Railroad company for the offices at Fort Wayne, Ind.

General Manager C. E. Trump of the Novelty Electric Works of Philadelphia has reason to feel gratified from the business of the last year, as it showed a steady increase each month, especially in November and December, at which time more business was done than at any time since the concern was organized. The reputation of honorable dealing with customers, which has always been maintained by the Novelty Electric Works, has always commended it to the electrical trade.

Partrick, Carter & Wilkins of Philadelphia have started with bright prospects under their new name. It is a debatable question if this concern will not have to move from the present quarters, if the business continues to show the growth which it has for the last few months. Treasurer Charles M. Wilkins, who has the management of the business details, reports that from all indications the coming year will be one of the best known to the business. They have under way many electrical novelties which will be offered to the trade.

The Michigan Pipe company of Bay City, Mich., manufactures creosoted wood conduits for underground wires, cross-arms, poles and railroad ties. It uses the Bethell process, it explains, "because the experience of engineers in Europe and America has proved that timber treated with dead oil of coal tar or creosote has withstood the ravaging effects of time and storm better than timber treated by any other process." It has prepared for circulation a very interesting document upon this subject which will doubtless prove valuable to persons interested in the matter.

The American Coffee company of Brooklyn is erecting a new power house in connection with its plant, which is about 70 feet wide and 120 feet long. The power house and boiler house have brick side-wall construction and steel supports and roofing. Adjoining the boiler house is a coal bunker about 20 feet wide, which carries the supply of coal in a steel bin about 30 feet above the ground. The whole plant has been designed with convenience and economy in view, and when completed will be a notable plant, which can be economically operated. The contract for furnishing and erecting the steel farmework of the building has been let to the Berlin Iron Bridge company.

The Central Electric company has taken the western agency for the Erickson outlet insulator. This insulator is brought out to meet the demands of engineers for a thorough and perfect protection at the ends of iron-armored conduit outlets. It very effectually and thoroughly prevents possible grounding of the wires on the iron conduits, and has met with a very ready sale. The company is carrying complete stocks of Insulac and Armalac, for the insulation of generators, motors and all kinds of high-potential work. These two compounds are fast establishing a reputation for permanency and absolute reliability. The new extra B. B. iron box bell, introduced and handled by the Central company, has proven to be one of the best specialties ever introduced into that branch of the electrical business. Its many new electrical and mechanical features commend it to cautious purchasers.

The Bliss School of Electricity at Washington, D. C., is now in the sixth year of its existence. It was founded by President Louis D. Bliss. The student is first given primary instruction along purely theoretical lines to a point where it can be supplemented by practice, and by restricting the course of study to electricity it is possible for the student, by following the work laid out, to receive a diploma at the end of one year. The school is pleasantly located on B street, N. W., handy to the various reference libraries of the city. The building includes a lecture hall, construction laboratory, dynamo room, drafting department and reading room. There is a post-graduate course which embraces advanced mathematics, mechanics, general electrical engineering work, and a deeper study into the theory of electricity than is expected in the regular course. The fact that the pupil upon leaving this school has received the practical education of building electrical apparatus is of great advantage when seeking employment. This year 22 states of this country, as well as Canada and Cuba, are represented by pupils in this school. The increase of students has been very large of late.

BUSINESS.

A letter opener which is made of tempered copper is a reminder from the Mansfield Tempered Copper company of Mansfield, O., which makes special claims for its product and enjoys a very extensive trade among the electrical fraternity.

The Western Electric company manufactures a very superior disk LeClanche porous cup cell especially adapted for bell and annunciator work. The company makes the battery complete, but will furnish the porous cup without zinc or glass jar if desired.

W. R. Garton has opened an office at 414 Ashland block, Chicago, where he will represent the Garton-Daniels Electric company, the Pittsburg Steel Hollowware company, the Massachusetts Chemical company and other eastern manufacturers. He will sell B. & S. drop-forge commutator bars and electric railway supplies in general, but will not give any attention to minor supplies or repair parts. Mr. Garton is a stockholder in the Raster Carbon Rheostat company, as well as consulting engineer for the same concern, and was also elected general manager of the Garton-Daniels Electric company at the last stockholders' meeting.

A new electric hoist designed and manufactured by the Denver Engineering Works company has proved successful in operation. The company has shipped one of the largest size to the Bushwhacker mine at Aspen, that is working very well, and another to the Hidden Treasure mine, and is now shipping four more, with an electric power plant, to Mexico. The company has this week booked orders for a seven-foot double-deck roasting furnace for Montana, one double mine timber-framing machine for Arizona, an electric-lighting plant of 1,200 lights for New Mexico, and a lighting plant for one of the largest public buildings in Denver, the lighting plants being furnished with the new Denver automatic engine.

A representative of the Western Electrician recently visited the works of the Partridge Carbon company in Sandusky, O., and found them exceedingly busy. The Partridge company has recently shipped an order of 19,000 street-railway brushes to Antwerp; it has also on the books another handsome shipment for London. Manager Speer reports that the factory is behind on orders, and, to quote Mr. Partridge's own words, they are working "night and day and cannot keep up." From the start the Partridge Carbon company has pursued the policy of producing the best goods at fair prices, and now that good times are again commencing the effect of this policy is being felt in the most gratifying manner. Under Mr. Partridge's personal management improvements in manufacture are being made, and it is now reported that before long the Partridge company will have a surprise for the trade.

A representative of the Western Electrician, during a visit to the works of Broomell, Schmidt & Co., limited, the manufacturers of the celebrated American fuel economizer at York, Pa., found the establishment one of the best designed and most complete manufacturing plants he had ever examined. The works are situated on the Pennsylvania railroad, with a switch running the entire length of the plant. Substantial buildings, consisting of a machine shop, foundry and boiler shop are equipped with the very latest tools, quite a number of which are special machines built exclusively for the manufacture of the American fuel economizer. In the erection of this plant the comfort and convenience of the employes have been looked after much more than ordinarily. Bath rooms and wash rooms are provided, all of which are heated and ventilated in the most perfect manner. A complete hydraulic plant is included among the other special fixtures, and consists of hydraulic cranes, elevators, presses and special attachments for putting together and testing economizer sections. Some very large economizers are now in course of construction at the works, and piles of sections are stacked up 30 feet high under hydraulic cranes awaiting shipment. The American fuel economizer has many points of superiority, and the manufacturers claim that it is the best economizer in the world. Messrs. Broomell, Schmidt & Co. have recently issued a new catalogue devoted exclusively to the economizer business, and will be pleased to send it to those interested in the subject. In this age of economy and close figuring no large steam user can afford to be without an economizer, and managers of large electrical and steam plants will do well to correspond with Broomell, Schmidt & Co. in regard to the American fuel economizer.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued February 1, 1898.

598,092. Alternating Current Motor. Alexander Heyland, Frankfort-on-the-Main, Germany. Application filed December 29, 1896.

The method of producing phase difference between the two inducing circuits of an alternating current motor consists in causing one of the circuits to be powerfully affected by the reaction of the secondary member of the motor, while reducing the effect of the reaction upon the other circuit.

598,106. Fusible Cut-out. Ernest A. Lowe, North Plainfield, N. J. Application filed March 5, 1897.

A box of insulating material having a partition at one end and holes through which the circuit wires pass, and recesses or stops at the other end, in combination with spring electrodes to which the circuit wires are permanently connected, such electrodes being held between the stops and within the box, a removable plug recessed at the side and having holes for the reception of the ends of the fusible wire, and adapted to be inserted into the open ends of the box and between the spring electrodes.

598,109. Insulating Attachment for Electrical Connectors. Richard P. Osgood and John D. Osgood, Methuen, Mass. Application filed June 28, 1897.

An insulating attachment for an electrical connector is described, comprising a rigid tubular jacket of non-conductive material and of shape to inclose the connector, and tubular elastic tips of non-conductive material each adapted to have one end stretched around one end of the jacket and the other hug closely around the wire, whereby a waterproof connection is made between the wire and the jacket at each end.

598,160. Electric Fire Alarm, Circuit and Signal Box. Lewis G. Rowand, Camden, N. J. Application filed January 5, 1897.

One claim is given: In an electric fire-alarm system, a main-line circuit, a plurality of boxes each having signaling devices in circuit with the main-line circuit, a spring-actuated wheel for operating the signaling devices, an escapement connected with said wheel, an adjustably weighted escapement pawl operating with the escapement, an electro-magnet in circuit with the signaling devices, a device carried by the armature adapted in the retracted position of the armature to lock said escapement, a wheel in connection with the spring-actuated wheel provided with a detent, a projection carried by said armature adapted in the retracted position of the armature to enter said detent.

598,172. Telephone System. Charles A. Barron, Robert T. Reid and James L. McDonnell, Tacoma, Wash. Application filed April 5, 1897.

Where there is a party-line a switch should be provided for each telephone, an electro-magnetic locking device for each switch and included in a normally closed local circuit, and means whereby to maintain the circuit of the locking device open-circuited when the lever is in use, whereby to prevent all of the switches except the one belonging to the telephone in use from being closed.

598,180. Apparatus for Electrolytically Producing Zinc. Carl Hoepfner, Giessen, Germany. Application filed October 7, 1893.

An electrolytic apparatus is employed, comprising a vessel containing a zinc chloride solution, a suitable insoluble anode and a discoidal revoluble cathode, the latter dipping partly into the solution, means for preventing chlorine bubbles formed at the anode from coming into reactive contact with the cathode, and electrical connections between the anode, the cathode and the source of electricity respectively.

598,183. Telephone System. Robert T. Reid and James L. McDonnell, Tacoma, Wash. Application filed May 7, 1897.

Provision is made for a combination with two line conductors and a source of electrical energy of a series of telephone apparatus arranged between the line conductors, each apparatus comprising a telephone and a lock-out device arranged in parallel between the line conductors, the circuit of the lock-out device being of higher resistance than the telephone circuit, a switch common to both circuits and arranged to maintain both normally open, and a resistance included in the line circuit.

598,184. Conductor for Electric Railways. Georg Ritter, Stuttgart, Germany. Application filed October 16, 1896.

In a three-wire electric railway system there is the combination with a series of pairs of contact devices capable of vertical movement, the contact devices being beveled on their lateral faces in opposite directions, of a car, and a shoe carried by the car and provided with a beveled end, whereby the contact devices will be alternately raised or depressed.

598,193. Apparatus for Electro-deposition of Gold and Silver. Emile Andreoli, London, England. Application filed October 1, 1895. Patented in England September 4, 1895.

In apparatus for the electro-deposition of gold, silver or other metal, anodes of peroxidized lead acting in the presence of and in combination with a cyanide or cyanide-compound solution are employed.

598,198. Electric Lamp for Bicycles. Peter A. Dowd, Boston, Mass. Application filed July 10, 1897.

An electric lamp carried by a bicycle and a current generator for the lamp comprising permanent field magnets attached to the bicycle frame, side pieces of non magnetic material attached to the field magnets, an armature journaled in the side pieces, and a friction disk or wheel secured to the armature intermediate of the field magnets to engage the periphery of the bicycle wheel and equalize the friction on the armature journals.

598,199. Mechanism for Starting, Stopping and Controlling Speed of Motors of Electric Cars. Frank H. Foster, Brooklyn, N. Y. Application filed Augu[illegible]

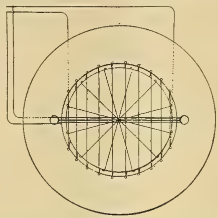
The combination [illegible] with an electric motor, a current controller therefor and means through which an electric current may be passed to them, of an electro-magnet, a conductor for leading an electric current thereto, a switch through which the flow of this current may be permitted and interrupted as required and mechanism intermediate the electro-magnet and the controller, whereby the controller may be automatically operated from the electro-magnet to start and control the speed of the motor when the switch is operated in the required direction.

598,208. Electric Meter. Carl D. Raab, Kaiserslautern, Germany. Application filed December 30, 1896. Patented in Germany April 12, 1895; in France December 11, 1895, and in Austria June 26, 1896.

A motor wattmeter for alternating current is provided with one or more metallic rotary armatures acted upon by two sets of magnetic fields having each a difference of current phase, one of the sets being produced by the main or direct current and the other by two shunt currents.

598,209. Electric Meter. Carl D. Raab, Kaiserslautern, Germany. Application filed June 24, 1897. Patented in Belgium February 27, 1897.

A motor wattmeter for alternating currents having a rotary armature without current supply and a coreless solenoid, in combination with two coreless shunt field coils of like polarity so arranged as to form a common magnetic field.



NO. 598,092.

598,218. Adjustable Support for Incandescent Lamps. William J. Going, Amsterdam, N. Y. Application filed May 26, 1897.

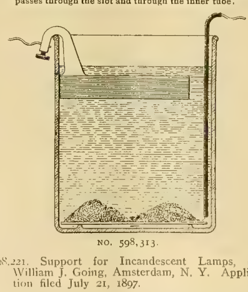
In an adjustable support there is the combination of a bracket having a hemispherical cavity, a ring swiveled on the outer edge of the bracket, a part extending between and journaled in diametrically opposite sides of the ring, and a rod threaded on one end and extending through the part and adapted to bear upon the wall of the cavity.

598,219. Support for Incandescent Lamps, etc. William J. Going, Amsterdam, N. Y. Application filed July 21, 1897.

A yoke is swiveled on a bracket to turn universally and is provided with a threaded aperture, and a rod having a threaded end passing through the aperture and adapted to bear upon the curved bearing surface of the bracket to hold the yoke from turning.

598,220. Support for Incandescent Lamps. William J. Going, Amsterdam, N. Y. Application filed July 21, 1897.

A portion of a disk is fulcrumed on the spindle at right angles to the axle of the disk; a yoke is swiveled on the spindle to move universally; a tube having a threaded end passes through the free end of the yoke, the tube being slotted longitudinally; a tube within the outer tube is connected to the latter through the slot, and a conducting cord passes through the slot and through the inner tube.



NO. 598,313.

598,221. Support for Incandescent Lamps, etc. William J. Going, Amsterdam, N. Y. Application filed July 21, 1897.

Claim is made for the combination with a bracket provided with a spherical socket, of a ball within the socket having a threaded aperture extending therethrough, and a threaded tube extending through the aperture and adapted to bear upon the sperical surface of the socket, the tube being slotted longitudinally, a tube within the outer tube connected to the latter through the slot and adapted to slide therein, a friction device to slide on the exterior of the outer tube, and a lamp carried on the end of the outer tube.

598,260. Electrical Conductor. Louis C. Werner, Broadbrook, Conn. Application filed June 15, 1897.

An electrical conductor extends along a line of way and has a bent portion out of alignment with the body of the conductor, supporting means for engaging the bent portion and supporting the conductor, and a conducting bridge-piece spanning such bend and in alignment with the body of the conductor.

598,269. Polarized Signal Bell. Frank R. McBerty, Downer's Grove, Ill. Application filed November 24, 1896.

The combination is described with a polarized magnet and a centrally pivoted armature therefor, of a tube of copper surrounding the armature and a helix surrounding the tube of copper, the helix being connected with the circuit of the magnet and being adapted to neutralize the magnetic effect thereof on the armature.

598,271. Brush-holder. August J. Oehring, Chicago, Ill. Application filed June 30, 1896.

In a commutator brush-holder for dynamo-electric machines there is the combination with the commutator brush of a dog bearing laterally upon the brush, and a spring actuating the dog to hold the brush securely in position.

598,272. Instrument-winding Device. August J. Oehring, Chicago, Ill. Application filed October 12, 1896.

An armature core is secured in position by a chuck, and a shaft projects from the armature core, the shaft having a tapered guiding portion at an outer end thereof, whereby wire may readily be guided into position upon the core about the shaft.

598,273. Instrument-winding Device. August J. Oehring, Chicago, Ill. Application filed November 28, 1896.

Means are provided for winding coils of wire upon the armature core, with automatic means for discontinuing the winding of each coil when a predetermined number of turns have been received thereby.

598,276. Self-restoring Annunciator. Josef Steiner, Brooklyn, N. Y. Application filed May 23, 1896.

Cores are mounted upon the retaining plate, the annunciator drop is journaled in the ends thereof and comprises the armature, target, plate, and the screw securing the several parts of the annunciator drop together.

598,285. Telephone Apparatus. Frank B. Cook, Chicago, Ill. Application filed March 25, 1895. Renewed September 16, 1897.

A sectional switchboard consisting of a frame and removable and replaceable switchboard sections, each one of which is equipped with suitable apparatus including cords, plugs and switches, whereby each section may be connected by the apparatus mounted on the section to any other section or other switches.

598,313. Electro-deposition of Lead. Ernest P. Clark, New York, N. Y. Application filed June 8, 1897.

The process of producing finely divided lead consists in first partially changing an acetate-of-lead solution into an acetate-of-zinc solution and then depositing lead by passing a current of electricity from a lead anode through the solution to a cathode.

598,316. Electric Gas-lighting Apparatus. Christian Eickmann, Indianapolis, Ind. Application filed July 3, 1897.

In a gas-igniting machine means are provided for connecting the explosion chamber with a furnace, the priming valve is adapted to conduct gas from the supply pipe to the chamber, the electrode in the chamber is electrically connected, the main supply valve is connected to the pipe, and means are connected with the valve and the electrodes by which a circuit is formed and broken to throw off an igniting spark.

598,318. Electric Furnace. James E. Hewes, Philadelphia, Pa. Application filed April 27, 1897.

Provision is made for a chamber into which the material is fed, a reciprocating rammer for expelling material from the chamber, pencil-holders pivotally supported on each side of the outlet of the chamber, and circuit connections for the pencils.

598,328. Terminal Head for Electrical Conductors. Charles H. Sewall, Chicago, and Henry E. Procunier, Oak Park, Ill. Application filed August 22, 1896.

A stem of conducting material forming part of an electric circuit projecting from the outside surface of a base or holder and surrounded by a non-conducting bushing, a metallic connector mounted on the bushing, means for interposing another part of an electric circuit to complete upon one side of base or holder the circuit between stem and connector.

598,358. Electric Circuit Controller. William T. Budds, Charleston, S. C. Application filed August 30, 1897.

An electric circuit controller comprising a wheel of conducting material having peripheral projections on its body portion, and a plain segmental portion at one side of less length circumferentially than the body portion, and the wheel being cut away at one side of the segmental portion, the area of the cut-away portion being equal to that of the segmental portion.

598,408. Machine for Making Type Bars. Benjamin F. Bellows, Cleveland, Ohio. Application filed May 21, 1894.

By an arrangement of diverging distributing channels and dividing partitions by which the number of the channels is increased from the top downward, pivoted switches are arranged and connected in rows in the channels; electro-magnets are adapted to severally operate the rows of switches, with a distributing trough having an opening through which communication is had with the distributing channels; pins are connected in the several electric circuits, and matrices are adapted to engage with the pins and thereby complete the magnetic circuits.

598,410. Fire and Burglar-alarm System. Charles P. Bostian, Milton, Pa. Application filed April 27, 1897.

Claim is made for the combination with a signal wheel and contact spring of the stop-lever, mechanism for throwing the stop-lever out of the path of the pin, including three slotted links, a vibratory lever engaging two of the links, an arm connected with the lever, an inflammable cord connected to the arm, a manually operated cord also connected to the arm, a lever engaging the slot of the third link, a spring for operating the lever and a thermostatic detent for the lever.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, FEBRUARY 19, 1898. No. 8

Modern Lights in Ancient Fittings.

At the dinner of the Fellowship Club at Kinsley's on Monday evening the decorations of the banqueting room merited and received especial attention. The room was transformed into a Turkish apartment for the occasion—that is, the walls and ceiling were thus decorated; the table equipage was quite modern and Occidental. The hangings of the hall and balconies were of rare old Turkish rugs, tapestries and fabrics. Turkish lamps, plaques, shields and arms were disposed with artistic skill and excellent effect, and the whole arrangement was very pleasing. Some of the pieces used are supposed to be 500 years old and were of great value. The collection was selected from the stock of Marshall Field & Co. and draped with much taste by the designers of that establishment. The Oriental stuffs and bric-a-brac employed were insured for over $40,000. An especially noteworthy decoration was a framed Aubusson tapestry, "The Montenegrin," copied from a painting with rare delicacy.

In the center of the room was a mimic pond, banked with moss. The water was represented by a mirror, and on it were pond lilies, while about the margin were English yellow primroses, daffodils, hyacinths and umbrella plants. In the asparagus at the edge some 60 miniature incandescent lamps were concealed.

In harmony with the general design the lighting effect was subdued. The curious old Turkish lamps and lanterns encased colored incandescent lamps, and the dim light from them added greatly to the effectiveness of the interior. The word "Fellowship" was outlined in varicolored miniature lamps over the entrance to the room. In all about 300 lamps were specially wired and placed for the occasion. Current was taken from the isolated plant in the building, and the extra electrical work was executed by the Chicago Edison company.

Fifty-year Franchise Wanted.

The Danville Gas, Electric Light and Street Railway company is attempting, under the Allen law, to secure a 50-year franchise from the City Council. The company's franchise was granted seven years ago, and it has 13 years to run. At the last session of Congress a bill was passed locating a soldiers' home at Danville. The grounds selected are three miles east of the city and a mile and a half east of the present terminus of the street-railway company's lines. The corporation desires to extend its tracks to the soldiers' home and double its tracks through the city to its present eastern terminus. To do this, it is claimed, it will require $50,000, which must be raised by bonds to be sold in New York. It is also claimed that eastern capitalists will not advance the money on a franchise that has only 13 years to run.

The part of the line to be constructed runs through the village of Germantown and in the country. For that part last summer the company obtained a 50-year franchise. There is much opposition to granting the 50-year franchise for the Danville portion of the line, and the mayor, E. R. E. Kimbrough, will veto the ordinance if one is passed. There are 14 aldermen in the council, and to pass the ordinance over his veto will require 10 votes, which, it is believed, is more than the street-car company controls.

The company claims that the street-car line is now operated at a loss. It also runs the gas and electric-light plant. For the year ended December 31, 1896, the street-car company's net profits are stated to have been $45,856, but this is said to have been due to profitable lighting contracts and not to the transportation business.

Chicago City Railway's "L" Project.

The plans of the Chicago City Railway company to build an elevated line from Thirty-ninth street to the river, to relieve the congestion of traffic upon the surface lines in the downtown business district of Chicago, have attracted considerable attention and provoked much comment, favorable and otherwise. It is universally admitted, however, that there is urgent need of relief and that the surface lines at present are taxed to their utmost capacity, but property owners on Dearborn street are opposed to the project. The grounds upon which objection is based are those which would be raised against any elevated structure or other additional occupancy of that busy thoroughfare.

President Bowen of the Chicago City Railway company authorizes the statement that the new enterprise will be part of the South Side system and that the plans are now being prepared under his direction. "The congestion of traffic upon the surface lines made some such step absolutely necessary," said Mr. Bowen. "Our north-bound cars are crowded before they reach the business district during certain hours of the day, and there is much inconvenience and delay caused by frequent stopping to allow passengers to alight. If we can arrange to bring the patrons of the company who live in the extreme southern part of the city downtown from Thirty-ninth street on express trains we can save 15 minutes in our running time and give the people living north of Thirty-ninth street better accommodations. It is our purpose to take the cars from the surface lines at Thirty-ninth street, shut the gates and shoot them downtown on this elevated line. Passengers who do not want to go all the way downtown can be transferred to the cars that run on the surface lines north of Thirty-ninth street."

MODERN LIGHTS IN ANCIENT FITTINGS.—DECORATIONS FOR THE DINNER OF THE FELLOWSHIP CLUB.

For more than a year Mr. Bowen has been studying the conditions and methods of other cities, and his engineers have reported upon several schemes. The tunnel plan in London, the Boston subway and like schemes were all declared impracticable in Chicago because of peculiar local conditions which it is asserted would make the cost prohibitive. With a light overhead structure upon which street cars could be operated at a high rate of speed, it was thought, the problem could be easily solved. Mr. Bowen believes that the South Side corporation would be able to take care of the traffic of the territory it occupies for many years without any difficulty.

One great advantage of the proposed plan is the high rate of speed that can be maintained throughout the South Side system. South of Thirty-ninth street, at present, a much higher rate is maintained on the surface lines than north of that point; in the business district, especially during the winter months, the cable cars creep along after coal wagons, moving vans, etc., although there is a city ordinance against delaying a street car.

Mr. Bowen's investigations have convinced him that the increased traffic on all lines of the Chicago City Railway company's system that would follow this improvement would repay the expenditure required.

Niagara Power in Buffalo.

The Buffalo General Electric company is making preparations for using Niagara power in the operation of its station to light that city. It is the present plan to abandon the Court street station and build a new station elsewhere, in all probability, or it may be erected on the Court street site. The apparatus necessary for making the change of plants has all been ordered from the General Electric company of Schenectady. As the current from the Falls is transmitted at a voltage of about 11,000, the first necessity will be transformers to reduce this voltage, and these machines, 11 in number, have been ordered. They will have a combined capacity of over 2,700 kilowatts, or about 4,000 horse power, and will transform the Falls current into a current of heavy amperage but of only 352 volts. These transformers will mark the end of the Cataract Power and Conduit company's line and the beginning of the new plant. As a matter of safety, they will be fed by two independent cables so that the light and power service will not be interrupted in case of a breakdown of either transmission system. Each cable will be capable of carrying the entire power of the station. The 352-volt current will be brought from the lower side of the static transformers into the station on copper bus-bars an inch thick and about six inches wide, and from these bars the distribution will be made to the various machines.

The uses of power supplied by the Buffalo General Electric company's station are practically three—high-tension direct currents for street lighting, which includes all outdoor arc lights used at night; low-tension direct current for small mercantile and domestic powers, such as elevators, press motors, laundry plants, etc., and high-tension alternating currents for inside arc lighting and various uses. The street-lighting equipment of the station will consist of 12 250-light units arranged according to a system that recommends itself as efficient and economical. Current from the bus-bars will be used to drive 200 horse power motors which will stand between each pair of 125-light machines. The ends of the motor armature shaft will be connected to the armature shafts of the two generators, and the direct current from the unit will supply 250 arc lamps of 10 amperes each.

The low-tension current for small power equipment will be obtained from two rotary transformers of 300 horse power each. These transformers will be practically of the same type as are now in use in the Buffalo Street Railway company's plant in connection with Niagara power. In reality they are compound machines, the current from the bus-bars actuating one side of the machine as a motor and the direct current of 550 amperes being generated by the other side of the machine.

In the matter of frequency changers the Buffalo General Electric company's plant will have machines that will be somewhat novel, as there are no other machines like them in the United States. It is understood that smaller machines are being built for use in Brooklyn, but the Buffalo machines will be much larger and more unique. The current that comes

from the Falls is one of low frequency of alternation, it being 25 cycles per minute. As this is too slow, the frequency changer is introduced to increase the rapidity of cycle, with a result that a current of 62.5 cycles to the second and a voltage of 2,200 will be obtained. In the frequency changers there will be 12 poles and an armature revolution of 375.

As yet the Cataract Power and Conduit company of Buffalo has found it quite impossible to decide on a general schedule of rates for Niagara power, as it is found that, so far, at least, it is quite desirable to figure on each application by itself.

A Home-made Alternator.

By B. F. Fells.

To make a 12-inch ring alternating-current dynamo, begin with the ring (see Fig. 1), the dimensions of which should be: Inside diameter, 12 inches; thickness of rim, one-half inch; width of rim, 2¼ inches. A piece of flat iron can be purchased, cut the right length, hammered into a circle on a mandrel and the butts welded. Then turn the ring

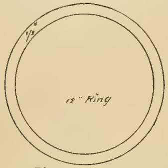


Fig. 1: Ring

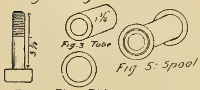


Fig. 2: Bolt   Fig. 4: Disk

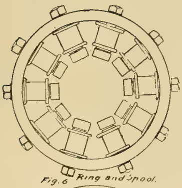


Fig. 6 Ring and Spool.

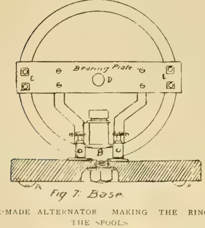


Fig 7: Base.

A HOME-MADE ALTERNATOR MAKING THE RING AND THE SPOOLS

true on a lathe. Next buy 10 bolts 3⅜ inches from inside of head to tip and seven-eighths inch diameter, as in Fig. 2. Now secure enough brass tubing to make 10 sleeves to fit over the 10 bolts, for forming the magnetic spools. The outside diameter of the brass tubing should be 1¼ inches and the inside seven-eighths inch. Cut the tube into pieces 1¾ inches long, and we have the sleeve as in Fig. 3. These sleeves must be provided with flanges. The latter can be made from sheet brass, about one-eighth inch thick, 2¼ inches diameter and bored with a hole to correspond with the sleeve over which the disk is to fit. Fig. 4 shows a disk. In soldering the disks to the sleeve, about one sixteenth of an inch space should be left on the sleeve, outside, as in Fig. 5 which [illegible] for wire connection, as will be seen further on.

The spools may now be [illegible] on the 10 bolts and the winding [illegible] In chucking a spool in the lathe [illegible] metal purposes about 110 feet of No. 22 double cotton covered magnet wire, wound in 10 layers (about 275 turns), will answer. The end of the wire on each spool is passed through a small hole previously cut in the disk nearest the center of the ring when in position.

Then apply four coats of shellac to the spools, allowing each coat to dry before putting on the next.

The spools are now ready to be placed in the ring. First divide the ring into 10 parts, and drill the holes for the spool shafts as in Fig. 6. The nuts may be placed on the shafts, or bolts, and the whole made firm. Care must be taken to so adjust the spools that the wire connections will produce north and south poles, which is accomplished by reversing the order of the wiring. This causes the current to take opposite directions around alternating spools. The ends of the wires are best united by little set-screw couplings which are sold at any electrical supply store.

Now the ring must be furnished with a wooden platform and set up, as in Fig. 7. The feet (A A) are brass screw-heads. A longer bolt can be substituted for the regular ring bolt at B and put through the platform as shown, thus securing the ring to the base very firmly. Bearing cross-pieces, one for each side, must now be made from brass one-fourth inch thick and 2½ inches wide. An inch hole is bored precisely in the center of each at D, and two three-eighth inch holes put in at E E for the supporting bolts. Corresponding holes are drilled in the ring. Binding posts (H H) can be purchased ready-made and fixed at the base as shown, where connection is effected with the two free ends of the field winding.

The armature is made by cutting very thin pieces of iron according to a pattern. Fig. 8 is an armature pattern intended for the pattern of the dynamo in process of construction. After making one pattern from tin, the other pieces can be marked off and cut with tinners' shears. Iron sheets of about 55 to the inch are the best. The armature is built up with thin paper (tissue) between each iron piece, shellac being used as the gumming agency. Fig. 9 shows a section of the armature core, seven-eighths inch thick. This hole is cut one inch diameter, and brass flanges of proper size are clamped by means of screws to either side, thus holding the same firm, as in Fig. 10. This figure also shows the process of winding on No. 20 double cotton-wound magnet wire.

The plan of winding is similar to that employed in the spools. The direction of winding is reversed for each tooth. About five layers of wire will be enough. Just before winding, put a coat of shellac on the armature core, and apply two or three thicknesses of silk fabric, winding over this.

We now have the ring and the armature core ready for the bearings. Fig. 11 shows the bearing plates affixed at B B. Four brass tubes, each 1¾ inches long, and of a diameter to conform to the bolts that are received by the plates, are now required. These tubes in position for one end of the dynamo are marked A A. Short shafts (C C) are also placed. These are hollow and are provided with small oil cups (E E) to lubricate the spindles that revolve within. The method of attaching the hollow shafts to the bearing plates is shown in section in Fig. 12, in which C marks the plate and D the shaft. It can be seen that the end in the plate is threaded, while a pin prevents the same from turning and loosening. In Fig. 13 we have a sectional view of the armature core and collecting rings in position. The armature core fits over a small brass hub B, as shown, and this hub is attached to the shaft C. The wood hub (D) is turned to 2¼ inches diameter at the smallest part, and three-fourths inch wide between the shoulders. The rings can be cut from seamless brass tubing.

Fig. 14 shows the bearing plate that goes on the side with the collector rings, brushes, etc. The brush-holders are made with ordinary binding posts and large-sized brass wire shaped at right angles where the end passes through the post. Copper ribbon can be used to effect the connection between the brush and binding posts. Fig. 15 shows the dynamo completed. The brass work can be polished, the wood base stained, and the iron work japanned. A small pulley can be set-screwed to the shaft and the machine operated.

Electrical Imports in Canada.

From the trade and navigation returns of the Dominion of Canada for the year ended June 30, 1897, recently issued, the following instructive figures are taken. They show the value of the imports of the goods named from the United States and from Great Britain and Ireland:

Class of Imports—	United States.	United Kingdom.
Electric motors, generators and apparatus.	$420,425	$ 5,688
Brass articles	267,492	35,125
Carriages and cars of all kinds	516,163	6,160
Copper articles	53,426	5,473
Engines and locomotives	158,860	4,024
Portable machines, etc	149,742	2,018
Steam pumps	24,128	694
Iron and steel rails	52,763	27,702
Boiler tubes	82,082	10,432
Covered wires	54,515	7,139

Commenting on the showing of the year, the Canadian correspondent of the Iron Age says: "It will be seen that the British column continues to shrink, while the American continues to swell. Of carriages, railway cars, etc., Canada's imports from the United States show an increase of $200,862 by comparison with the figures for the previous fiscal year * * * * * Of electric motors, generators and apparatus we have imported $233,314 worth more from the United States than in 1896. * * * * Most of these gains, excepting that in agricultural implements, have been made at the expense of British manufacturers, though in some cases, as in electrical machinery and goods, it is Canadian manufacturers whose business has been captured. The installment of several electric plants, notably the equipment of the Lachine Hydraulic and Land company's great works and of the equally great works of the Chambly Manufacturing company, brought into Canada a considerable amount of electrical machinery before the close of the fiscal year."

Electric Mail Van.

Between the General Postoffice and Paddington, in London, an electric mail van has been in daily operation for about a month. The daily distance traversed, in six trips, is 35 miles, and frequently the total weight of mails carried exceeds a ton. Forty secondary-battery cells, having a capacity of 172 ampere-hours at a discharge rate of 30 amperes, are employed. They are carried in a single tray under the bottom of the van and weigh about 1,300 pounds. A bipolar ironclad 3½ horse power motor is used having two armature windings, two commuta-

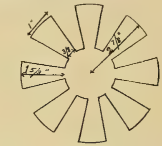


Fig. 8.: Armature Core Plan

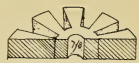


Fig. 9: Section Armature Core.

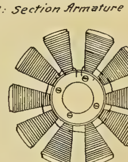


Fig. 10: Winding.

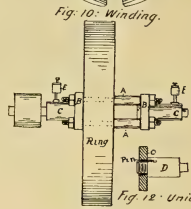


Fig. 12 · Union.

Fig. 11: Bearings.

A HOME-MADE ALTERNATOR.—BUILDING THE ARMATURE.

tors and two series field windings. A pinion on the armature shaft meshes into the central wheel of a differential gear. To provide for the different speeds of the driving wheels in turning curves the countershaft of the driving gear is made in two halves, each half being driven by the differential gear. Sprocket-wheels and chains transmit the power from the countershaft to the driving wheels. The driving wheels are 3½ feet in diameter and have solid rubber tires. The controller permits five combinations, which secures different speeds and tractive force: (1) All the windings on the motor, together with a resistance, in series; (2) the same, but with the resistance cut out; (3) the two field windings in parallel and the armature windings in series; (4) the fields in series and armature windings in parallel, and (5) the two field windings in parallel, connected in series with the two armature windings in parallel. The motor may be reversed at the slow speed by placing the regulator handle back of the neutral or top notch. The action of putting on the brakes also puts the motor out of circuit. The steering wheel is shown in front of the operator. It governs the movement of the vehicle by a connecting rod and a "fifth wheel," to which the forward wheels are attached, over the front axle. The maximum speed of the van is from 10 to 11 miles an hour, and the service is said to have been thus far satisfactory. The picture and data are from the London Electrician.

Present Efficiency of Incandescent Lamps.[1]

By John E. Randall.

The present efficiency of incandescent lamps for central stations lies somewhere between three watts per candle power and $3\frac{3}{4}$ watts per candle power. It might appear from these limits that no advance had been made in the lamp industry during the last 13 or more years of its extensive growth. As long ago as 1885 we heard of $2\frac{1}{2}$-watt lamps, and $3\frac{1}{2}$-watt lamps were considered a regular article of commerce. At the Detroit meeting of the National Electric Light association in 1887, a $1\frac{1}{2}$-watt lamp was described. As no one in the business is advocating longer life than was claimed 10 years ago, it would appear from these figures that the manufacture of incandescent lamps had retrograded, and was approaching the state of a lost art, and if the falsity of this supposition were not demonstrated every night one might be pardoned for thinking that the industry was disintegrating.

Every investigation of claims for extremely high efficiency has shown that there was some hocus-pocus; either the candle was of the wax-taper variety, or the watt was not one of the family that James

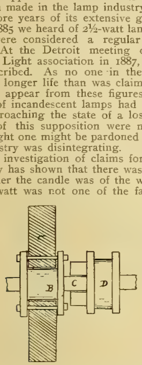


Fig. 13: Collector Ring Hub

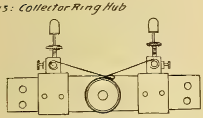


Fig. 14. Bearings

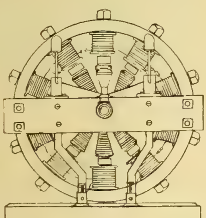


Fig. 15: Complete

A HOME-MADE ALTERNATOR —THE DYNAMO COMPLETED.

made famous, or else the lamps didn't live to tell the tale.

Finally people forgot about the one-watt and the two-watt lamp, and concluded to take what they could get, which might be anything from three watts to five watts, depending upon what the maker had ready to send. It really was a matter of small moment whether the lamps were three or five watts per candle, since they all went to five watts the day after they were placed in circuit.

This state of affairs has continued with some improvement until a comparatively recent date. In the meantime elaborate series of life tests were made under the auspices of the Franklin Institute. W. H. Pierce made an extended test, several foreign tests appeared, and tests were made at the Ohio State University of samples from 13 different makers. There was nothing promising in the general results of all these tests, and for a time the outlook was rather gloomy. Progress was being made, however, although the results were not published. It was found that lamps whose initial efficiency was less than three watts per candle power would not last a reasonable time on commercial circuits. This set the maximum limit of efficiency. The minimum was set by what the people would accept, and it was placed at four watts. More recently all energies have been exerted to produce types suitable for the various kinds of uses. We have now the highly efficient central-station lamp, the isolated-plant lamp and the railway type, besides numberless modifications for special uses.

Among the lamps in the Franklin Institute tests was one Weston tamadine 16 that maintained its brilliancy and gave most excellent life. It was the only one of the type, and almost the only one in the test that gave any indication of good quality, as quality is gauged at present. So far as that test went the tamadine lamps were a commercial failure, yet this one lamp showed what might be gotten from a cellulose filament. Since then the cellulose filament has been brought to a degree of perfection far surpassing the prototype. While made by a process differing from Mr. Weston's, the present filaments possess all the good features to be found in his early lamp and have outgrown most of the poor ones. Upon the quality of this cellulose filament I base a claim that the present efficiency of incandescent lamps is better than it ever has been, and is so much better that the lighting industry is to be congratulated.

The incandescent lamp is still a filament of carbon of high resistance hermetically sealed into an exhausted glass globe, with conducting wires passing through the glass. Its quality as an illuminant depends directly upon the quality of the filament and the quality of the vacuum.

The object of the vacuum is three-fold:

(1) To reduce the energy expended per unit of light emitted, because of the heat lost through convection.

(2) To prevent injury to, and destruction of, the carbon by burning.

(3) To prevent injury by abrasion or so-called "air washing."

Any gaseous envelope will carry away the heat-energy from an incandescing body so rapidly that a great amount of power must be supplied to maintain its surface at a temperature corresponding to a certain brilliancy, the core being at a far higher temperature. This loss becomes less, as the pressure of the surrounding gas is decreased, until a point is reached beyond which no further changes can be detected. When the vacuum reaches 1 part in 1,000, the loss becomes extremely small and, after a vacuum of 1 part in 10,000 is reached, the loss is negligible, so far as our present methods of measuring light can determine.

Some years ago we made a series of measurements showing the relation between the degree of vacuum and the power necessary to produce a definite candle power from a lamp filament. The net results showed that, so far as the convection losses are concerned, the degree of exhaustion ordinarily found in incandescent lamps is better than need be.

Carbon at high temperature cannot resist the attacks of oxygen. Therefore all oxygen must be eliminated, even slight traces causing injury to the carbon surface.

We would naturally suppose that the residual gas was composed of oxygen and nitrogen, in the proportions found in air. The induction coil shows that such is not the case, and I believe that in a properly exhausted lamp, although no other gas may be purposely admitted to displace it, no oxygen remains. It is known that a filament will rapidly decline in brilliancy if the vacuum is low, because the radiating surface is injured, but it will not burn out. Very few lamps burn out because of poor vacuum, unless cracked, when, of course, fresh oxygen is constantly admitted.

While the effects of abrasion formerly were considered of importance, my experience indicates that, at present, at least, they are of small consequence. A high degree of exhaustion, as measured by a vacuum gauge, is not the object to be attained; an unchanging vacuum is essential to the maintenance of the highest brilliancy. In the type of lamp made five years ago a positive injury resulted if the vacuum were made too high. The disintegration of the filament, due to evaporation of carbon, not only injured its surface but seriously darkened the bulb.

The vacuum does not grow poorer with age, provided the lamp is properly made and exhausted in the first place. The vacuum changes as the lamp is burned, and a part of the lampmaker's art is to reduce these changes to the smallest degree. But the vacuum is finally higher than at the start. Nothing is tighter than the glass and wire joints of a properly made incandescent lamp. Absolutely no leak can be detected after years. In some lamps used for at least 12 years in rheostats where the current at times brought them to full brilliancy, the vacuum was as good as when first made.

Many think that all lamps gradually lose their vacuum. This mistaken notion was caused, no doubt, by a fault common to many individual lamps having the old form of seal at the base, and illustrates the influence which apparently unimportant details exert upon quality, as well as the necessity for wide information and extended experience in successfully making lamps.

The present lamps, made by modern methods, have perfect joints, or else the leaks are so bad as to be instantly discovered by proper inspection.

The filament is the most important element of the lamp so far as efficiency is concerned. Filaments are now made from a form of cellulose, reduced chemically to an amorphous state.

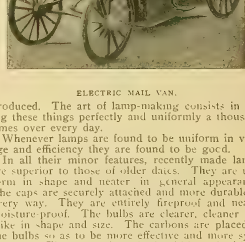
Not many years ago, when the bamboo carbon was supreme, we had occasion to complain about the poor quality of a certain lot of bamboo strips which we had received from an importing firm. They said that they could not guarantee a natural product. This furnished the key to the success of the cellulose filament. Art replaces nature, breaking down the structures of a fiber, reducing it to a protoplasmic condition and then spinning a thread radically different in appearance and character from the original material. Instead of whittling down a stock to make a lamp filament, we now cause the filament to grow.

The quality of the filament is determined by the thread. The process of squirting threads is controllable if proper skill, experience and appliances are employed. Yet the weather is more controllable than is the quality of the product, when any of these requisites is lacking. It is easier to shave down strips of bamboo to a uniform size, or to weave braids of silk fibers that will appear to be even, than it is to squirt a cellulose thread of uniform diameter, but the bamboo strips and the silk braid will not be uniform in weight. They cannot, therefore, make uniform carbons.

It may be supposed that the coating of carbon applied in treating the filaments fills up the pores and depressions, thereby correcting the defects due to irregularities in texture and surface. This is not true. A poor base-carbon cannot make a good lamp. When one filament is found to be better than another, its superiority can be attributed to the base-carbon.

In purity, density, surface polish and uniformity—the features that determine quality and maintain efficiency—the cellulose filament, properly made, far excels any other kind.

A graphitic coating covering an amorphous carbon body, in a vacuum, is, so far as known, the best combination for fulfilling these conditions. The science of lamp-making consists in knowing how the carbon body can be formed, how the graphitic coating can be given and how the vacuum can be


ELECTRIC MAIL VAN.

produced. The art of lamp-making consists in doing these things perfectly and uniformly a thousand times over every day.

Whenever lamps are found to be uniform in voltage and efficiency they are found to be good.

In all their minor features, recently made lamps are superior to those of older dates. They are uniform in shape and neater in general appearance. The caps are securely attached and more durable in every way. They are entirely fireproof and nearly moisture-proof. The bulbs are clearer, cleaner and alike in shape and size. The carbons are placed in the bulbs so as to be more effective and more symmetrical. The connections, both within and without the bulbs, are more secure. Cracks and poor vacuums have about disappeared.

These features help the service that can be derived from the lamps. They form part of the general economy of operation, and, therefore, influence the efficiency to the extent of being more satisfactory and reliable.

Another point worthy of consideration is the evolution of types suitable for the different conditions of service; one for close regulated central stations, one for poorer regulation and isolated plants in general, one for street railways and other purposes in which, for certain reasons, the service is severe. Added to these are the almost innumerable varieties for special uses, such as window decorations and signs. Finally, the use of cellulose has made the 220-volt lamp a commercial possibility.

It may be claimed that the new lamps are more delicate than the older bamboo, in that they cannot be run as long before the filament will break.

The principle upon which all practical methods of illumination is founded, that of incandescence excessive activity—limits the period of effective service and induces early destruction. We may as well accept the condition of limited life, in the case of the incandescent lamp knowing that no other light is better in this respect, if all factors are considered.

I am not willing to admit that the cellulose filament is more delicate, either in transit or in service. Under identical conditions, it will live longer than

1 Read before the Northwestern Electrical association, Milwaukee, Wis., January 20, 1898.

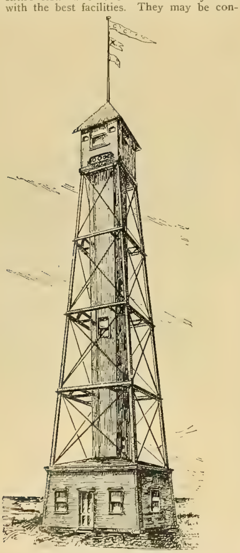
any other form of filament. Furthermore, the individual life approaches nearer the average than has been the case with any other material. Any carbon filament which will not maintain its brilliancy should live to a good old age.

The life of cellulose lamps at three watts per candle power should not be compared with bamboo or silk at four. The four-watt cellulose railway lamp is giving more satisfactory service than those of other materials. Its light is more uniform and they last longer.

Recent lamps are approaching the ideal one which, when its work is done, breaks and thus announces its own "smashing point."

The best proofs of any claim are those based upon actual performance. In support of the claim that the present efficiency of incandescent lamps is more satisfactory than the past, I submit some comparisons.

In the subjoined table are results of tests made upon three classes of lamps: First, the 110-volt cellulose; second, the 110-volt untreated bamboo; third, the 50-volt treated bamboo. The initial watts per candle power were nearly 3.2 for all. The bamboo filaments represent their class, both the 110-volt and the 50-volt having been carefully selected. The tests upon these were a part of a series upon a large number started in groups of various initial watts per candle, and the results are consistent with those of the entire test. The tests were carefully conducted with the best facilities. They may be con-



CABLE LAYING ON LONG ISLAND SHORE.—POSTAL TELEGRAPH-CABLE COMPANY'S MARINE OBSERVATORY AT FIRE ISLAND.

sidered reliable. Both lamps were at one time extensively used and well regarded. The figures shown for the cellulose lamps are the combined results of a number of tests made at various times and places and by different persons, but evidently under similar conditions, so far as regulation is concerned. There is excellent agreement, not only

LAMP TESTS.

Average candle power and watts per candle power of bamboo and cellulose lamps during various lengths of burning.

During a run of ...		0 Hrs.	100 Hrs.	200 Hrs.	300 Hrs.	400 Hrs.	500 Hrs.	600 Hrs.	700 Hrs.
Average c. p.	Cellulose, volt 110...	16	[illegible]	[illegible]	15.63	15.41	15.17	14.96	14.74
	Bamboo, volts 110...	16.	[illegible]	[illegible]	[illegible]	[illegible]	10.4	9.9	9.6
	Bamboo, volts 50...	16	[illegible]	[illegible]	[illegible]	[illegible]	14.2	[illegible]	[illegible]
Av. watts per c. p.	Cellulose, volts 110...	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.51	3.71
	Bamboo, volts 110...	[illegible]	[illegible]	[illegible]	4.08	[illegible]	[illegible]	[illegible]	4.90
	Bamboo, volts 50...	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

in averages but in individual cases, both in candle power and in watts per candle power. The oldest tests, which were made over three years ago, show the poorest results. This fact suggests a gradual improvement in the quality of the cellulose lamp. All the lamps entering the tests were samples of commercial lamps taken at random from large lots. No claim is made that the results are remarkable

I believe that they can be relied upon to represent faithfully the present efficiency of the incandescent lamps supplied for central-station use.

The remarkable feature is the close agreement between various lots made at widely different times. This feature is the criterion of quality. Upon it depends the successful introduction and use of the highly efficient lamp. I believe that they can be relied upon to represent faithfully the present efficiency of the incandescent lamps supplied for central-station use, because every result was used in the table, whether good, poor or indifferent.

This table shows the mean candle power during a certain period of service, and not the value found at the end of the period. For example, if a cellulose lamp, whose candle power is 16 at the start

CABLE LAYING ON LONG ISLAND SHORE.—WINDING CABLE ON REEL FOR SHIPMENT.

and whose economy is 3.2 watts per candle power, is in service for 500 hours, it will average 15.17 candle power during that period, but will give less than that value at the end. If a 50-volt bamboo lamp, of the same brilliancy and economy, is used for the same length of time, its candle power will average 14.2. The 110-volt bamboo will, under the same conditions, average only 10.4 candle power. In the latter case, especially, the great change in the brilliancy of the lamps after they had been running for a short time would be very noticeable.

Viewed in another way, if a station furnishes a service of 50 cellulose lamps to one customer, and to his neighbor a similar number of 110-volt bamboo, charging the same for each service, the one would be justified in demanding that his lamps be renewed every 100 hours, in order to keep his place as bright as his neighbor's.

A 50-volt bamboo lamp, to maintain the same average brilliancy as the 3.2-watts cellulose during any period from 300 to 700 hours' service, should have an initial efficiency of 3.4 watts per candle power. A four-watt 110-volt bamboo would not maintain its brilliancy as well as a 3.2-watt cellulose.

While none of the lamps involved in the tests failed before 600 hours, no other conclusion has been drawn from this fact than that the percentage of early failures of lamps, operated under good condition, is so small as to be neglected.

Lamps to-day are more uniform in wattage; a variation in current of two per cent., either way from the average, is rare. Candle power is tested while the lamp is revolving. Thus, the true horizontal value is determined. The value of light standards is carefully guarded and constantly checked. The accuracy of all instruments employed in the photometer room is kept at the highest degree. While an official standard of candle power does not exist this fact has not caused the great divergence in the light value of different lamps. The most prominent manufacturers are in agreement as to the value of the 16 candle power lamp. Their standards check more closely than do those of the technical schools.

lamp for the low-economy silk and bamboo and by improving its regulation, been able not only to reduce the price of service to its customers, but to increase its lamp capacity over 25 per cent.

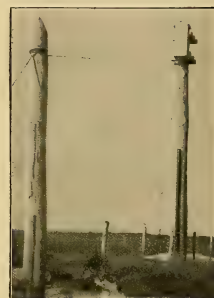
There is still one condition to be fulfilled in order that incandescent lighting may be more profitable—the voltage at the lamps must be kept steady at all times. There has been improvement, but much more is possible and desirable. Everything about lighting service is improved where regulation is improved, even the customer's temper.

Remedial Patent Legislation.

[From a Washington correspondent of the Western Electrician.]

The House committee on patents has acted favorably on the bill amending the patent law of March 3, 1897, so as to limit the restrictions against patenting an article on which a foreign patent had already been issued or previously described in a foreign publication. The bill provides that the restriction shall not apply to applications made within 60 days from the passage of the proposed amendment.

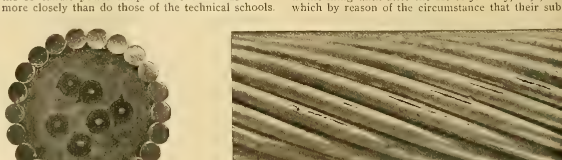
By an act of Congress approved March 3, 1897, the law relating to patents was amended so as to provide that no patent shall be granted in this country for an invention previously patented in a foreign country on an application filed more than seven months prior to the filing of the application in this country. By the terms of this act it went into effect on January 1, 1898, and all applications not reaching the Patent Office before that date were debarred from the benefits of the law. It has been found upon investigation that this radical change in the law, that existed for almost a century, has worked much wrong and hardship to American inventors generally, and in many cases has injured citizens of



CABLE LAYING ON LONG ISLAND SHORE.—CABLE TERMINAL POLE AT CONKLIN'S POINT.

other countries who extend to us reciprocal favors of like character.

The effect of the enactment of this bill will be to extend the already manifest intention of Congress to afford to a peculiarly situated class of inventors an opportunity to come in within a certain time and, as heretofore, avail themselves of a previously continuously existing law, and thus incidentally also to legalize those applications for patents which by reason of unavoidable accident, mistake, ignorance, lack of opportunity, or the like, have been delayed in the filing until after the 1st of January, 1898, and which by reason of the circumstance that their sub-



CABLE LAYING ON LONG ISLAND SHORE.—END AND SIDE VIEW OF CABLE.

Lamps vary in candle power because of carelessness and sometimes deception in rating. In the Columbia factory the accuracy of rating is considered a matter of prime importance, and constant effort is made to keep the standards exact. Each lamp has a mark whereby its history may be known. The volts at which it gives its normal revolving horizontal candle power, together with the current passing, are marked upon a suitable label. A record of these items for each lamp is made at the same time upon a sheet. These sheets are the indices of uniformity in the product.

One of the largest alternating stations in the country has, by substituting the highly efficient cellulose

ject-matter had been previously patented abroad for more than seven months are, by the radical changes wrought in the uniformly existing previous law by the act of March 3, 1897, now either void or destined to become burdensome upon the Patent Office and to those concerned.

In the case of all that large class of subjects of invention and patent which consists of new articles of trade, upon the introduction and manufacture of which new industries are built up, great delay in, if not complete prohibition of, introduction of their manufacture here will result through inability to protect it by patents in this country. It is only reasonable that those who thus take the

risks of introducing what is at first sight uncertain of success, but finally develops into a great industry and beneficial to our country, should have some guaranty of being able to indemnify themselves after having pointed out the successful way to others. The alternative would be to abandon the entire manufacture of the new article during the tentative period to foreigners, who would thus acquire such a start and such an advantage as to substantially preclude competition here for many years.

In view of the importance as well as fairness of the proposed measure, and the many reasons that can be urged in favor of its speedy enactment, there is every reason to believe that it will soon be on the statute books.

A. F. T.

CABLE LAYING ON LONG ISLAND SHORE.—TRANSFERING CABLE FROM REELS TO DECK ON WRECKING SCOW.

Cable Laying on Long Island Shore.

One of the most difficult pieces of submarine cable laying undertaken in recent years was successfully performed by the Okonite company, limited, for the Postal Telegraph-cable company on January 25th. The cable was the heaviest of the kind ever manufactured and laid and reposes in Great South Bay on the ocean side of Long Island, between Fire Island and Conklin's Point, six miles away on the Long Island shore.

Every yachtsman and many others know the dangerous character of the Great South Bay, owing to its constantly shifting shoals and sandbars. Only a native "bayman," and one of many years' experience, is a competent pilot through the devious and dangerous channels of the bay. The difficulties and responsibilities of the undertaking were such that the Postal company insisted upon the manufacturers of the cable laying it themselves. This the Okonite company did so successfully that it reflects great credit on the careful planning and preparations necessarily made in advance.

This six-mile cable forms the most important link in the line just completed by the Postal company for its ship-news service. The company has recently established several marine observatories outside the port of New York for the purpose of reporting at the earliest possible moment the arrival of steamships. The most exposed and the most distantly located of these observation towers is that just completed at Fire Island. From this observatory, which is on the ocean side of Fire Island, a substantially constructed overhead land line runs to the bay side of the island, where it meets one end of the submarine cable. The cable crosses the bay, as mentioned above, landing at Conklin's Point. Here it connects on a terminal pole with another land line which runs due north to the Long Island railroad tracks. This land line is a splendid example of modern telegraph construction, and is provided with two copper wires weighing 210 pounds to the mile. From the point where the land line meets the Long Island railroad tracks, it follows an old overhead line along the railroad, then along the highways until the outskirts of Brooklyn are reached, where it goes underground to No. 4 Court street, Brooklyn, one of the Postal company's offices. From that point the line runs in an aerial cable carried on the elevated railway structure to the Brooklyn bridge, thence over the Brooklyn bridge in another aerial cable to the New York terminus, whence it goes underground to the Postal company's main office at 253 Broadway, New York. In its course this important line passes through several townships on Long Island and three of the boroughs of Greater New York.

In order to fully understand the amount of preliminary work and planning required for the successful carrying out of this project, it will probably be as well to follow the cable on its journey from the Okonite company's manufacturing plant at Passaic, N. J., to its final resting place in the waters of the Great South Bay. The cable, as mentioned, is six miles long, was made in one length, and weighs about 65 tons. It is one inch and three quarters in diameter, contains six Okonite wires arranged as three pairs, and is heavily armored with galvanized iron wire. The cable weighs four pounds to the foot, which is about 5½ times the weight of an ordinary ocean cable. At the Okonite company's factory there is one of the largest testing tanks in the United States. The cable as manufactured was coiled in this tank and put through the usual severe tests. After satisfactorily passing through these tests, the end of the cable was led through a window to a heavy reel erected on bearings on a flat-car alongside the factory buildings. A leather belt was passed around one end of the reel and carried through the window to a shaft in the factory. By this means the reel was turned and the cable was wound upon it. It required three of these reels and three flat-cars to transport the cable.

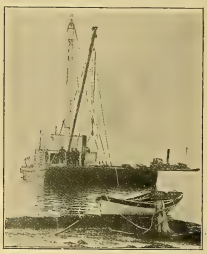
From Passaic the reel-laden cars were transported by as direct railroad connection as possible to New London, Conn., where they were run out on a pier and the cable was unwound and coiled on the deck of a large wrecking scow. The cable lay on the deck of the scow very much as it did in the testing tank at the factory.

CABLE LAYING ON LONG ISLAND SHORE.—GUIDING CABLE WHILE PAYING OUT FROM THE SCOW.

The reason for such a roundabout road was that New London was the nearest point at which a scow of the requisite size and of sufficiently light draft could be obtained. This was made necessary owing to the shoals and sandbars in the Great South Bay over which a heavy draft scow could not pass. Captain T. A. Scott, the famous New London wrecker, was in charge of this part of the work, and the skill he displayed in handling the heavy mass of material was truly wonderful to one unaccustomed to such work. The scow was 85 feet long, 35 feet broad, and drew about three feet of water with the 65 tons of cable on its deck. The cable was passed from the reels on the cars through a heavy snatch-block suspended from a derrick on the scow, and was coiled on the deck without a kink in six layers, containing about a mile each. This is the first time it is believed, that a cable of such length and size has been laid in such a manner. Heretofore heavy reels have been used with various degrees of satisfaction. The manner in which the cable was paid off from the deck of the scow in laying left no doubt in the minds of the experts who were present as to the success of this method.

When the cable was coiled down and made fast, the scow was taken in tow by a heavy, sea-going tug and towed down the Sound to a point off the Staten Island shore, where the outfit was obliged to anchor owing to heavy weather. The following day and night the journey was completed from Rockaway Inlet to Fire Island. The scow was anchored near the terminal pole of the Fire Island land line and a heavy rope was carried ashore in a small boat, passed through a pulley made fast to the terminal pole, and carried back to the scow. The rope was attached to one end of the cable, the other end of the rope being passed around a steam winch. In a very few minutes after the winch had started, the end of the cable was ashore, where it was made fast. A light-draft tug drawing but four feet of water was then made fast to the scow and the tedious and dangerous journey across the Great South Bay was commenced. The word dangerous is used advisedly, because if the scow had gone ashore on any of the numerous sandbars the great weight it was carrying would have rendered it well nigh impossible to release it before the bay froze over, which was threatened at any minute.

The tug was piloted by an expert bayman, Capt. L. Candee and George T. Manson of the Okonite company.



CABLE LAYING ON LONG ISLAND SHORE.—LANDING SHORE END OF CABLE ON FIRE ISLAND.

George Saxton. Owing to his thorough knowledge of the channels and bars the cable was successfully laid in the wonderfully short time of four hours, without a single hitch or delay from any cause. The cable was paid out over the stern of the scow in much the same manner as it was carried aboard. A guiding block was rigged up on the stern of the scow through which the cable passed, and an extemporized brake was used to regulate the speed of paying out. The numerous illustrations accompanying this article will give a very clear idea of the numerous steps of the work.

Valuable assistance was rendered in the shipping and laying of the cable by R. D. Blish, the cable expert of the Southern New England Telephone company, and the laying of the cable was witnessed by E. B. Baker, general superintendent of the Southern New England Telephone company, who was greatly pleased with the methods and means used. E. G. Cochrane, general superintendent of construction for the eastern division of the Postal Telegraph-cable company, was present, as well as Capt. W.

CABLE LAYING ON LONG ISLAND SHORE.—PAYING OUT CABLE.

Dr. W. S. Hedley, writing in a recent issue of the Electrical Review of London, makes the rather sweeping statement that, "In the opinion of the present writer everything seems to point to the fact that all commercial forms of electric-lighting currents, varying as they do from 80 volts upwards, are dangerous to human life under certain conditions. Fortunately," he adds, "the required conditions do not often occur in actual practice, and when they do occur they admit of remedy."

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And further this affiant sayeth not.

FRANK FOSTER KENWORTHY.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES. Notary Public.

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Telephone men, especially those operating or supplying apparatus for the larger exchanges, should give careful attention to Judge Toulmin's decision upholding two claims of the Scribner multiple switchboard patent, as reported on another page. The contest was between the Western Electric company, the owner of the Scribner patent, and the Home Telephone company, and the latter was held to have infringed two, and only two, of the claims of the patent. As a matter of course, independent telephone men will make a careful study of the two claims which are upheld.

In this country the renting of electric motors is unusual; the machines are usually sold outright; but in England it is proposed to let them out by the year, and, what is of greater novelty, the proposition is made on behalf of a municipal corporation. The idea is to increase the day load of a municipal plant, and is credited to the electrical engineer of the city of Bradford. It is hoped that the small power users of that city, to whom the outlay for the purchase of motors and equipment might seem prohibitive, will be willing to rent small motors, and thus increase the demand for current. The motors for hire range from one-half to six horse power, the rent varying from $7.50 per annum for the smaller size to $25 for the larger. The annual payment includes the supplying and fixing of the motor and the necessary controlling apparatus, and also a fortnightly inspection by a member of the city electrical staff. The consumer has to provide all oil, brushes, etc., which must be obtained from the corporation stores. The wiring is also done by the consumer. The charge for current for motors is five cents for each kilowatt-hour, and a great expansion of this curious branch of the municipal business is anticipated. As there appears to be no central-station company in Bradford, although it is a city of over 200,000 inhabitants, no private industry suffers by the paternalism of the municipal corporation.

Among the several theories advanced to account for the terrible catastrophe in Havana harbor are two connected with the electrical equipment. One hypothesis is advanced by Captain-general Blanco of the Spanish army, who, in a telegram to the charge-d'affaires at the Spanish legation in Washington, says that the disaster is "believed to result from an explosion of the boiler of the dynamo." This can only refer to one of the main boilers of the steam plant of the ship, from which the steam for the dynamo engines was obtained. It is hardly conceivable that the boiler in use could have exploded. The Maine was a modern ship, launched less than eight years ago, and its mechanical equipment included all the automatic safety appliances known to steam users. Besides, the vessel was in port, and only a moderate pressure of steam could have been needed. Moreover, all descriptions of the destruction of the ship indicate that the explosion was forward of the boiler-room. The possibility of a boiler explosion is very slight, and the examination of the wreck will enable the point to be decided with certainty.

The suggestion that electric wires in the ammunition chamber caused the explosion is still less tenable, for the very good reason that the presence of electrical conductors in the powder magazines is sedulously avoided in the wiring of all men-of-war. The vault containing the explosives is lighted through a tightly glazed port-hole by carefully guarded incandescent lamps. There are no electrical lamps, fixtures or circuits of any kind in the magazines, and there is no possibility that a short-circuit could have caused the explosion.

The cause of the loss of the Maine with the lives of 250 seamen of the United States Navy seems to be veiled in obscurity. If it shall prove that the ship was blown up by enemies of this country, we rest assured that the reparation exacted will be commensurate with the awful enormity of the offense.

Telephone subscribers in all parts of the country who are depending upon Bell exchanges for service will be interested in the controversy at Washington over the right of operating companies to enforce restrictions of the use of the instruments for which a stipulated rental is paid. The court has declared that the company has a legal right to prohibit the use of subscribers' instruments by outsiders or for other purposes than the actual business of the individual, firm or corporation in whose establishment the telephone is placed. The court held that the telephone company could not be expected to furnish service to those who were not subscribers, and it was not fair to have the lines and instruments of the system used by outsiders, as this would impair the usefulness of the service to subscribers. Of course the only consideration that enters into the case, so far as the Bell interests are concerned, is the question of payment for service. That corporation is perfectly willing that the entire community shall be permitted to use its lines and instruments if compensation is forthcoming. For this reason the company advocates the placing of slot-machines in public places, such, for instance, as drug stores, hotels, etc., and it denies to those living in hotels the right to use the telephone for which a certain yearly rental is paid by the keeper of the hostelry. It was an attempt to enforce this rule that precipitated the controversy at Washington, which culminated in a legal decision practically upholding the local Bell company's claims.

While it is undoubtedly true that telephone privileges are often abused, it is equally certain that the corporations operating exchanges throughout the country will gain nothing by following such a narrow policy as that outlined by the Washington concern for the guidance of its patrons. The Bell company is so generally disliked, and with so much reason, that it is really a wonder that the management does not attempt to conciliate rather than antagonize the public.

Although the street-railway system of Glasgow is held up as a model for Americans, so far as management and advantages to the municipality are concerned, it is not so highly regarded nearer home. Robert P. Porter, in an interesting contribution on this subject, says that the system of fares in vogue in that city could not be followed in an American town. "While some of our municipal-ownership advocates are eulogizing this system," he says, "the more advanced undertakings in England are adopting the American plan. Thus the elevated traction of Liverpool has adopted a uniform fare," and "the London Central Underground railway has also decided upon a uniform fare, according to class." Even the Glasgow district subway, a private enterprise opened since the city assumed control of the surface roads, has rejected the cumbersome system in vogue upon the city lines. A much more important feature of the Glasgow enterprise is the fact, as stated by Mr. Porter, that a wide-awake American street-car company could have leased the Glasgow tracks when the city took them over, installed a modern system, extended the track, and, with the Glasgow wages, just half those paid in this country, carried passengers as cheaply, if not more cheaply, than Glasgow is carrying them to-day. It could, furthermore, have assumed all the risk and paid the city more money per annum with profit for mileage and common good than the municipality will get by operating the cars itself. An American syndicate offered to install a mechanical system in Glasgow, and, if granted a reasonable lease, guarantee the common good fund a net income of £50,000 ($243,325) per annum, the city to assume no risks. Mr. Porter's conclusions, after a personal examination of the operation of the system and the reports of the officers in charge, is worth reproducing here: "Of course, Glasgow knows its own business best and it is only when we are told that if we would only do things as Glasgow does, we should do so much better than we do do, that I am tempted to answer that the Glasgow experiment is of no value to an city in the United States. The offer referred to may be open at the present time, and Glasgow may yet wisely accept it. However this may be, the actual results in Glasgow, when put to the American test, in no way indicate that the Glasgow experiment has either solved a problem in street-car enterprises, or is of the slightest value in pointing out a civic moral or adorning a municipal ownership tale." It seems to be the opinion of American street-railway and financial experts that the city of Glasgow would be much better off if it had made some arrangement for the operation of the system by a private company at a fair annual rental or division of the profits.

Telephone War in Washington.

[From the Washington correspondent of the Western Electrician.]

There has been a very brisk little gale in progress in this city during the last 10 days or so, regarding the use of telephones by subscribers and outsiders and also regarding the rate charged by the Chesapeake and Potomac Telephone company of this city. The matter was first brought to public notice by the institution of a suit against the telephone company by the proprietor of the Fredonia Hotel, who secured an injunction against the telephone company, restraining it from removing the telephone from his hotel. Mr. Danenhower, the complainant, explained his position as follows:

"In my warehouse I have had a telephone for 13 years. It has been in my hotel for eight years. On November 1st I received a letter from Mr. Bryan, of the company, calling attention to the use of the telephone. I paid no attention to it. The first of the year I failed to receive a bill from the company for the use of the telephone for that quarter, but on the 10th of January I sent a check. I pay $100 for the hotel telephone and $120 for the one in the warehouse. The same day I sent the check I received another letter from Mr. Bryan, stating that if the telephone was used as it had been the company would remove it from the hotel. On January 14th, after I had used the telephone four times, a guest of the hotel used it, and when he had finished, Mr. Bryan called me up personally and told me if I didn't cease the illegitimate use of the telephone it would have to be removed. We had some conversation which was ended when he said he would send a man over to confer with me in regard to the matter.

"This representative of the company visited me. He said I had no right to call up my own warehouse from the hotel outside of any business connected with the hotel. I was told that if I should telephone to find out whether my wife was sick or not, I would have to pay 10 cents. I was told further that I rented the warehouse telephone simply to sit in my office and receive all messages relating to business connected with the warehouse, and could only send out messages relating to its business. The representative of the company said that the hotel instrument was strictly for hotel business only, and might be used by employes of the office. I was again told that if I telephoned home to find out whether any of my family were sick, I should have to pay the specified amount for outside messages. It was stated that the best way out of the difficulty would be to put a slot machine in the office. For this I was told that I would be required to guarantee $10 per month. If the receipts did not come up to that I should have to pay the difference. Anything over that would be divided between the company and myself. I would get 25 per cent. and the company 75. I refused to do this and the injunction was issued."

Justice Cox based his decision upon the fact that "the telephone company is obliged to maintain a special plant, and is entitled to charge for every message sent." He said further: "All that the law requires is that the company shall not discriminate between its patrons, but must serve all persons on the same terms. The explicit terms of the contract, made between the parties in 1896, are that the telephone be for the subscriber's use only, and on a breach of the terms the contract may be violated.

"When the subscriber allows others to use his telephone it is an abuse of the time of the telephone operator. It is also an infringement on the rights of the Bell Telephone company, which receives a royalty from the defendant. Furthermore, it is an infringement of the rights of other subscribers. It is very annoying for a subscriber to call for a certain number and be told that the connection he wants is busy, that being due to the fact that a non-subscriber is using, free of charge, the telephone with which connection is desired.

"The hotel guest is entitled to the use of the telephone in the hotel, but no one is entitled to the use of the telegraph if the telegraph company has an instrument in the hotel. The guest does not have his telegrams sent free of charge, nor does he secure the service of messengers and the use of carriages without pay. Why should he be allowed to use the telephone without paying for its use?"

The following amendment to the District Appropriation bill has been adopted: "Provided, That from and after the passage of this act it shall be unlawful for any person or any telephone company doing business in the District of Columbia to charge or receive more than $50 per annum for the use of a telephone on a separate wire, $40 for each telephone, there being not more than two on a wire, $30 for each telephone, there being not more than three on a wire, and $25 for each telephone, there being four or more on the same wire."

This incident was the cause of a universal flurry among the citizens of Washington, subscribers and non-subscribers to the telephone company. The druggists especially have taken up the matter as being especially aggrieved. Last summer an order was issued by the telephone company requiring all druggists to put in slot machines, and if the proprietor of a drug store wished to use his own telephone, he had to pay 10 cents, the same as outsiders. If a drug store had the agency for a laundry every time a message was dispatched to the laundry, the drug store had to pay. The druggists are now talking of boycotting the telephone company, and they are upheld in this by a number of citizens. The Chesapeake and Potomac Telephone company is the only telephone company in this city, but a bill has been introduced in the House authorizing the Automatic Telephone Exchange company of Washington and London to lay wires and establish a telephone service, the rates not to exceed $5 a month. The bill also provides that the company shall "allow each subscriber an unlimited use of the telephone supplied."

Commenting upon this controversy William E. Curtis, the Washington correspondent of the Chicago Record, says:

There is a telephone war in Washington which has got into the courts and Congress, and will undoubtedly result in the passage of a law regulating the charges and the service on some more equitable basis than we have been accustomed to. The charges in Washington range from $80 to $120 a year, according to the distance of the subscriber from the central office and the number of messages sent. For $80 a year the subscriber has the right to send 600 messages within a circuit of a mile, and there is a sliding scale for longer distances and a larger service. All messages above the number given are charged extra at the rate of 7, 8, 9 and 10 cents each, according to distance, and when the subscriber signs a contract he stipulates that he will not permit the telephone to be used by any persons except the members of his own family or his employes. Having discovered that the guests of the Fredonia Hotel were using the telephone freely, the company served notice upon Mr. Dannenhower, the proprietor, that it would be removed for violation of contract unless they paid toll. Mr. Dannenhower went into court and got a temporary injunction restraining the company from interference. The case was argued last week, and Justice Cox of the District Supreme Court made the injunction permanent, but imposed the stipulation that Mr. Dannenhower should observe the terms of the contract with the telephone company, which forbid the use of the instruments by his guests.

"It may be used," said the court, "for the benefit and the accommodation of boarders, such as sending for a wagon or carriage, but it may not be used by them for social purposes nor for the calling of stock reports or ordering theater tickets or any business of that kind. The explicit terms of the contract made between the parties are that the telephone is furnished for the subscriber's use only, and for a breach of the terms the contract may be violated."

In other words, the contention of the telephone company was sustained. Hence several hotels have ordered the instruments removed. The House of Representatives inserted a provision in the bill which appropriates money for the government of the District of Columbia prohibiting the telephone company from charging more than one-half of the present rate. That bill is to be taken up by the Senate this week, and it is believed that the amendment will be concurred in.

According to the Washington Star, many of the subscribers to the service of the Chesapeake and Potomac Telephone company are up in arms against the company over its enforcement of its alleged right to prevent any but the subscriber from using a telephone. A movement is reported to be now on foot on the part of a number of subscribers, professional and business men (other than hotelkeepers), to pool their interests and make a test case of the refusal of the company, for instance, to permit anyone but a doctor, or some one connected with his office, using his telephone.

Recently a Washington man leased desk room in his office to two friends. The lessor had a telephone in his office, for which he paid an annual rental of $130. When his tenants came in, the telephone company informed the subscriber that the tenants would not be allowed to use his telephone unless each paid $30 a year for the privilege, in addition to the $130 which he paid. The man told the president of the company that his tenants would use his telephone free of charge. The president replied that if they did the telephone would be taken away. The man dared the president to carry out his threat, and the telephone was not moved.

Washington subscribers declare that the telephone company is constantly making such threats and carries them out only when it thinks the offending subscriber is a person whom it can afford to antagonize. The statement is made that the result of such a policy is that Smith, who may be an important man or a man of some influence in Washington, permits his telephone to be used by anybody he pleases, while Jones, next door, who is not so important a personage, has to conform to the company's demands or lose his telephone.

Telephony in the South.

[Special correspondence of the Western Electrician.]

The Arkansas and Tennessee Telephone company is rebuilding its line between Memphis, Tenn., and Osceola, Ark., and will soon have it in good condition for business. The company has one wire over the Mississippi River at Richardsons, Tenn., and will soon add another. The span is 1,900 feet.

The Cumberland Telephone and Telegraph company has a large force of men building a line from Memphis to New Orleans. This company is now pushing the construction of both long-distance lines and exchanges in small towns in the South.

George W. Schenny of Memphis, who owns the Corinth and Greenwood, Miss., exchanges, will about the first of March put in at Greenwood a 200 switchboard in place of the 100-number board he now has in operation at that place. He is very much encouraged by the growth of business.

C. W. Bolton of Pontotoc, Miss., has lately acquired a franchise for a telephone system for that town and throughout the county. He now has a line in operation with five or six telephones on it.

One of the biggest deals in telephone property that has been made in the South was consummated a few days ago when the Cumberland Telephone and Telegraph company of Nashville, Tenn., secured control of the Southern Telephone and Telegraph company's lines, which extend through Mississippi and Louisiana. The Cumberland company's lines run through Southern Illinois and Indiana, Kentucky and Tennessee, so that the consolidation gives one company control of wires running from Illinois to the gulf. The capital of the Cumberland company is $1,700,000 and of the Southern $1,800,000. Exchanges will be put in the larger Mississippi and Louisiana towns and wires extended to Mobile. Under the terms of the deal one share of the Cumberland company's stock will be given for two of the Southern's stock. It is stated that new lines will be built to all important towns in the whole territory.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The recently formed Eastern Wisconsin Telephone company of Elkhart Lake, Wis., is making an aggressive beginning. It has absorbed the Sheboygan and Manitowoc County Telephone company, operating between Elkhart and Manitowoc, and has made application for a franchise at Fond du Lac and at Chilton, Wis.

The Mankato Citizens' Telephone company will ask the council of Mankato, Minn., for a franchise.

A telephone exchange will be put in at Nevada, Ia.

Mount Pleasant, Ia., is looking forward to better telephone connections. It will have lines to Winfield and Mount Union, and will also be on the long-distance line and can connect with Chicago, New York and other eastern cities.

Harry Lashway, manager of the Wisconsin Telephone company's office at Menomonie, Wis., has resigned and will go to the Klondike.

The Northwestern Telephone Exchange company is securing a right-of-way between Fairmont and Sherburn, Minn.

The Cumberland Telephone company of Cumberland, Wis., will have its system in operation the first week in March.

The Farmers' Electric Telephone association has been formed at Harmony, Minn., and will build a line to Cresco, Ia.

The Union Electric Telephone company has reduced its rates in Fillmore County, Minn., one-half.

R. L. Kraus and K. W. Doege have been granted a franchise for a telephone exchange at Marshfield, Wis.

T. W. Stone is working to put in a local telephone system in Benson, Minn.

E. M. Webster and J. R. Serrin are organizing a telephone system at Glenwood, Minn., and propose to cover the county.

D. B. Porter of Clinton Center, Ia., proposes to build a telephone line to Warsaw, Sewell and Corydon, Ia.

The Western Electric Telephone company of Britt, Ia., has applied to the council of Sioux Falls, S. D., for a franchise for a local telephone exchange.

The Dakota Central Telephone company of Aberdeen, S. D., proposes to extend its system through Ipswich, Leola, Roscoe, Eureka, Mound City and Bowdle, S. D.

Telephone Fight in Chippewa, Wis.

In the contests between the old and new telephone companies, or, in other words, the Bell and independent interests, there are frequent tilts that bring out the best qualities of the men engaged as the excitement enlists their hearty support. There was recently a case of this kind in Chippewa, Wis., according to the local papers. The rivalry between the two telephone companies occasionally assumed an interesting aspect, and incidents have occurred since the new company commenced the construction of its system that have set the entire town talking. The Bell people have naturally opposed the newcomer, and, as is well known, every effort was made to exclude it before the council granted a franchise. On Stanley Hill the Wisconsin Telephone company raised its poles about 10 feet, ostensibly to escape contact with the trees, but according to officials of the new company to prevent the wires of the competing system from being strung in that vicinity. J. C. Crowley, who has charge of the construction for the new company, succeeded in outwitting the Bell men in another instance not long ago. Mr. Crowley ordered postholes dug on the opposite side of the street from that on which he contemplated stringing wires. The next day Bell poles occupied the side of the street where the new company had dug the holes a few hours previously, and then Mr. Crowley and his men proceeded to erect the new company's poles where he wanted them.

Scribner Multiple Telephone Switchboard Patent Sustained.

The decision of the court handed down on the 9th instant at Mobile, Ala., in the suit brought by the Western Electric company against the Home Telephone company for infringement of the Scribner multiple switchboard patent, No. 330,061, is of more than usual importance.

Two claims of the patent, the second and fourth, were found infringed, and as these claims make clear the nature of the invention, they are here quoted:

"2. At a telephone-exchange central office, the combination of multiple switchboards with telephone lines, each permanently connected to a metallic portion of its switch upon each board, each telephone line being also connected through the contact points of its switches and to ground, and means whereby the circuit of the branch wire of any given line is opened when a connection is made with the line at any board, whereby any two lines may be connected together upon either of the boards without including in their circuits the contact-points of either of their switches.

* * * * * * * * *

"4. The combination, with a telephone line provided at each switchboard of a multiple system with a connecting bolt or switch, of a portion of said line connected through an annunciator to ground, and means for breaking said line when a connection is made with the telephone line at either end of its bolts or switches, substantially as and for the purpose specified."

The defendant company, early in 1896, installed a multiple switchboard designed by Paul Minnis of Mobile. Suit was commenced in August, 1896, and proofs were taken during the winter and spring following at Chicago, Baltimore and Washington, Messrs Charles E. Scribner, the inventor, and T. D. Lockwood and Charles D. Haskins, the experts, being witnesses for the complainant. Messrs. Charles D. Minnis, Clayton B. Clark and William S. Paca, experts of Baltimore, testifying for defendants. The hearing, which was had last June, occupied three days, the arguments being made by George L. Roberts of Boston and George P. Barton of Chicago for the complainant, and, on the part of fendants, by Charles B. Tilden of Washington, D. C., and Henry Hanaw of Pillans, Torrey & Hanaw of Mobile.

The legal and electrical questions involved are discussed in an elaborate and carefully prepared opinion of some twenty pages, from which the following extracts are taken:

"United States Circuit Court,
Southern District of Alabama.

"Western Electric Company
vs.
Home Telephone Company, Albert S. Lyons and Adam Glass.

February 9, 1898.
In equity.
No. 202

"Toulmin, Judge.

"This is a suit in equity brought by the Western Electric company, on letters patent of the United States No. 330,061, dated November 10, 1885, as the assignee of Charles E. Scribner, to whom the patent was granted, against the Home Telephone company, Albert S. Lyons and [illegible] Glass.

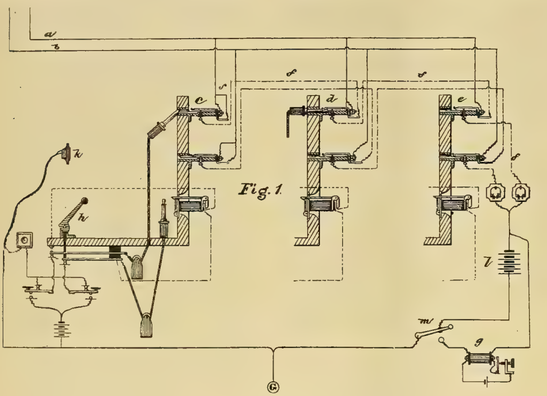
* * * * * * * * *

"Scribner, the patentee [illegible] for complainant, states the object of [illegible] and among other things says:

"'The patent in suit No. 330,061 is for a multiple switchboard. The result sought to be accomplished by the invention of the patent is the connection between any two subscribers' lines in a telephone exchange, the exclusion of contact points from the circuit of such connections, while at the same time, the indicator annunciators of such connected lines are temporarily cut off from their respective lines.'

* * * * * * * * * *

"The several or perhaps numerous contacts, the evidence shows, were liable to and often did maintain poor electrical union; often filled between their touching points, more or less, with dust or other foreign substance which impaired and even sometimes destroyed their contact, electrically speaking, and such several separable contact points of each line at each board, or board section, also constituted a series of breaks or breakable points in the talking circuit depended upon by users of telephones for the transmission of speech. The evidence in this case is strongly persuasive, if not wholly convincing, that the invention embodied in the patent involved herein overcame and eliminated these difficulties and produced a substantial and meritorious advance in this useful art. By means of this invention, as expressed in the patent, and as shown by the evidence, the series of separable contacts of each of any two lines to be brought together are cut out of the talking circuit when any two of the spring-jacks on a board, or board section, are electrically connected by a pair of plugs and their conducting cords; thus, referring to Fig. 1 of the patent [see accompanying illustration], if the upper plug is inserted into the spring-jack or switch c in the upper left-hand part of the figure, and then the lower plug is inserted into the spring-jack or switch on the same left-hand board, the subscriber's line a and the subscriber's line b will become electrically connected for talking purposes. At the same time each of the upper spring-jacks or switches d and e of the line a will be cut out of the circuit, and each of the spring-jacks or switches of the line b, lowest under d and e, will also be cut out."



SCRIBNER MULTIPLE TELEPHONE SWITCHBOARD PATENT.

After a consideration of the testimony of the witness Clark concerning some seven prior patents, the opinion proceeds:

"Whatever then be the merit or demerit, or the accuracy or inaccuracy of these statements and discussions, it remains that the patents mentioned do not, as they now exist, according to this witness, contain the invention covered by complainant's patent, but, on the contrary, that changes must be made in them before it is even pretended that they will show this invention.

"The Supreme Court, in Topliff vs. Topliff, 145 U. S., 156, p 161; has said:

"'It is not sufficient to constitute an anticipation that the device relied upon might, by modification, be made to accomplish the function performed by the patent in question, if it were not designed by its maker, nor adapted, nor actually used, for the performance of such functions.'

"The force of this ruling, and the similar ruling in Clough vs. Barker, 106 U. S., 175, is made manifest, in its practical application to the rights of parties, by the reflection that all earlier patents set up in defense against later patent sued upon, are but the record evidence of the status the art has reached. The rights under such later patent are subject to what this record evidence actually shows. To change this record, by permitting theoretical modifications of these earlier patents, would be the same in principle as to change, by interpolation or modification, any other evidence between the parties.

"The witness, Minnis, answer 24, discusses at great length the question of whether there is anything novel, and of a patentable character, in the patent in suit in view of patents Nos. 292,865, 292,866, 330,059, 330,060, 294,482 and 269,438. He does not say that he finds the invention of the patent in suit in either or all of these patents, but would make it appear that, by changing some or all of them, or by combining some of them together, thus resorting to the process of modifications and reorganizations, he would then arrive at this invention. For instance, he says: 'Thus it will be seen by means of these four patents we have been brought up step by step to an arrangement and combination almost identical with that shown in the patent in suit.' But this 'almost,' with its indefinite bounds, forms the missing link; and, it is thought, brings this form of attack on complainant's patent substantially within the rule pronounced in Topliff vs. Topliff, supra, and Clough vs. Barker, supra, and is also within the objections to such a course pointed out by Judge Coxe in the case of Johnson vs. Forty-second Street M. & St. N. Avenue R. company, 33 Fed., 500, where he says:

"'The defendant assembles every similar device, description or suggestion in the particular art not only, but also in analogous and even remote arts. Everything which has the least bearing upon the subject is brought in and arranged by a skillful expert in an order of evolution which resembles most clearly the invention which is the subject-matter of attack. Having thus reached a point where but a single step, perhaps, is necessary to success, and knowing from the inventor exactly what that step is, the expert is asked if the patent discloses invention, and, honestly no doubt, answers in the negative. There is always the danger, unless care is taken to divest the mind of the idea added to the art by the inventor, that the invention will be viewed and condemned in the light of ascertained facts. With his description for a guide, it is an easy task to trace the steps from the aggregation to the invention.'

"'In the law of patents it is the last step that wins,' says Justice Brown in Barb Wire Fence cases, 143 U. S., 275. * * * * If patent No. 321,390 covers broadly the identical invention covered by the patent in suit, as is claimed by defendants, why the substitution or change of bolts and contact switches, as suggested by witness Minnis? Why any change of construction in the arrangement shown in patent No. 321,390 if it possesses all the functions of the patent in suit?

"'The grant of letters patent is prima facie evidence that the patentee is the first inventor of the device described in the letters patent and of its novelty. The burden of overcoming the prima facie case made out by the production of the patent is upon the defendant, and the defense of want of novelty must be clearly established before a court will be justified in setting aside the patent on this ground. Not only is the burden of proof to make good this defense on the party setting it up, but it has been held that "every reasonable doubt should be resolved against him."' (Cantrell vs. Wallack, 117 U. S., 689; Palmer vs. Corning, 156 U. S., 342.)

* * * * * * * * * * *

"This patent was not 'the mere carrying forward of new or more extended application of the original thought' shown in patent No. 321,390, as claimed by defendants' counsel; nor was it 'a change only in form, proportion or degree, doing substantially the same thing in the same way by substantially the same means' as patent No. 321,390.

"It is true that it was a patent for new combinations of what were old elements when considered by themselves; but 'a new combination, if it produces new and useful results, is patentable though all the constituents of the combination were well known and in common use before the combination was made.' (Palmer vs. Corning, supra.)

"My opinion is that the patent in suit accomplished an absolutely new and useful result; that it was a pioneer invention."

After citing other authorities and comparing the claims in detail with an illustration of the defendants' switchboard, the opinion proceeds:

"From this comparison of the patent in suit with the model or diagram of the apparatus shown to be in use by the defendants, it seems clear to me that the defendant, Home Telephone company, has adopted substantially the invention alleged to be infringed.

"'In determining the question of infringement the court is not to judge about similarities or differences by the names of things, but is to look at the machines, or several devices or elements, in the light of what they do or what office or function they perform, and to find that one thing is substantially the same as another if it performs substantially the same function in substantially the same way, to obtain the same result.' (Cantrell vs. Wallack, supra.)

"There is no conflict in the testimony as to the fact that the invention covered by the patent in suit and the apparatus in use by defendants accomplish the same result; and there is no material conflict as to the construction and operation of the respective apparatus or devices shown by the patent and the admitted diagrams in the case; but there is a want of harmony in the conclusion of the witnesses on the conceded facts; there is a difference in their expert opinion on the question, whether the two machines or devices are substantially identical and employ substantially the same means to obtain the result, which it is conceded is the same. But the comparison made brings me to the conclusion, agree-

ably also to the weight of the evidence, that claims 2 and 4 are infringed."

No decree was made against the individual defendants, Lyons and Glass, the court holding that the evidence did not show that in their individual capacity they had violated any of complainant's rights, and the operation of the injunction was ordered suspended for 60 days after the entry of the decree on account of public inconvenience that might result in summarily enjoining the Home Telephone company in the use of its switchboards.

The language of the decree, as certified by the clerk of the court, is as follows:

"This cause, coming on to be heard, is submitted for decree on the pleadings and proof, and the same having been fully argued by counsel and duly considered by the court, the court is of opinion that the complainant is entitled to relief.

"1. It is therefore ordered, adjudged and decreed that the defendant, Home Telephone company, its officers, solicitors, agents, servants and employes, and each of them, be perpetually enjoined and restrained from directly or indirectly making or causing to be made, or using or causing to be used, or vending to others to be used, or distributing in any manner, the combination of multiple switchboards and telephone exchange apparatus made in accordance with or embodying or containing any of the inventions or improvements as described and claimed in claims two (2) and four (4) in the letters patent, the subject-matter of this suit, and from vending or distributing any such combination of multiple switchboards and telephone exchange apparatus, and from infringing upon or violating the said letters patent in any way.

"2. And it is also ordered, adjudged and decreed that said defendant, the Home Telephone company, forthwith destroy or deliver up to the complainant the combination of all the multiple switchboards in their possession, made in accordance with said claims two (2) and four (4) of said letters patent.

"It is, however, ordered that the injunction herein provided for shall not be operative until sixty (60) days from the date of this decree.

"3. It is also further ordered, adjudged and decreed that the bill as to defendants Albert S. Lyons and Adam Glass be dismissed at the complainant's cost.

"4. It is further ordered, adjudged and decreed, since complainant waives its right to a reference to a master for an accounting against the defendant, the Home Telephone company, that the said defendant pay complainant two cents as nominal damages and the costs of this suit."

Hudson Telephone Company.

Mention was made last week of the dispute between stockholders of the Hudson Telephone company of Jersey City, N. J. The following communication has since been received:

In order to prevent your being misinformed by Associated Press dispatches published in many papers and accounts in local papers of a bill being filed February 9th, asking for a receiver for the Hudson Telephone company and making charges against its officers, I write to say that no such bill has been filed and is not likely to be. I enclose you published denials on my part, which will be followed by those of others concerned. The matter is a libel published to injure the company.

This letter was signed by George H. Atkinson, as were also several statements published in the Jersey City News of February 8th, in which all the charges made against him and his management of the Hudson Telephone company are denied in detail.

Telephone Rates.

A dispatch from Lincoln, Neb., says that on February 16th "The case of Omaha citizens against the Nebraska Telephone company for a reduction of tolls from $5 to $3 per instrument was argued in the Supreme Court. The District Court at Omaha declared in favor of the citizens' petition and the company appealed. If the decision in the Supreme Court is against the company it will be carried to the court of last resort. The officials of the company declare they must go out of business if the reduction in rates is enforced, that it will be equal to the confiscation of the property of the company, and that, therefore, the federal courts may interfere."

Anti-Bell Movement in Western New York.

From the Niagara Falls correspondent of the Western Electrician.

The Western New York Telephone company has been incorporated with a capital stock of $500,000, to operate a telephone system in Buffalo and in the cities and villages of the counties of Erie, Niagara, Orleans, Genesee, Cattaraugus and Chautauqua. The directors and principal stockholders are: Edward Michael, $150,000 of stock. Henry Koons, $120,000. Alonzo K. Jones, Tracy C. Becker, L. P. Wesser and Isadore Michael, each $50,000; W. S. Grattan, $10,000, all of whom are of Buffalo, and Richard F. Rankine and Spencer J. Lawrence of Niagara Falls, each $10,000.

Messrs. Becker, Koons and Michael are men who are also interested in the National Electrolytic company of Niagara Falls, while Richard F. Rankine is secretary and treasurer of the Niagara Falls Paper company and a brother of William B. Rankine, secretary and treasurer of the Niagara Falls Power company. The company is certainly one of the best and strongest independent telephone companies organized in a long time. The territory in which it expects to operate is one in which the people are very anxious to be relieved of the Bell methods, and they will eagerly become patrons of a company that by its strength offers to give them a good service. It is probable that the company will use the automatic system. Tracy C. Becker says: "We are going into the business with our eyes open, and with a practically unlimited amount of capital, and we will spare no pains or expense to make it a success in every sense of the word. Until our plans are perfected, however, we deem it is best to keep the matter largely to ourselves."

New G. E. Motors.

The General Electric company announces a new line of direct-current motors of small capacity adapted to the direct application of power to small machines of all kinds. The new motors have been given the designation of "Type C A," and in their design the production of an efficient motor, sufficiently light and compact to allow of installation in cases where space is limited and absolutely rigid support unobtainable, has been kept constantly in view. A magnetic circuit, therefore, entirely of laminated

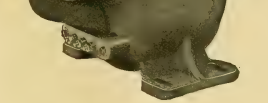


Fig. 1.

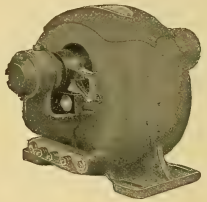


Fig. 2.

Fig. 3.

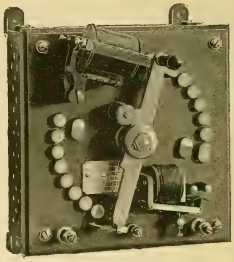


Fig. 4.

NEW G. E. MOTORS.

iron has been adopted, and greater lightness and compactness thus secured than would have been possible with cast iron. Furthermore, by the use of laminated iron a uniform magnetic circuit is insured. The construction of the armature, commutator and field coils follows closely that in the standard General Electric railway motors. The laminated armature core is toothed and wound with the Beckemeyer type coil. The leads from the armature are soldered directly into slots in the segments and the field coils are thoroughly taped and mounted on laminated pole-pieces. The armature can be withdrawn after taking off the pulley end bearing, and the field coils removed through an opening in the frame. In the larger machines the shaft is mounted on two similar swivel bearings, each self-oiling. The brush-holders are adjustable radially, and may be revolved around the commutator as required. The neutral point is very wide, however, and no adjustment of the brush-holder is necessary.

These motors are enclosed and thoroughly protected from mechanical injury, but thorough ventilation is provided by holes in the bottom of the case and around the commutator end of the armature. Should these motors be used in places where flying dust necessitates extra protection, the commutator and brush-holders may also be encased.

The speeds are lower than usual with motors of small capacity. Better provision for overload is thus given and losses are not so great. The regulation, efficiency and disposition of the material in the "C A" motors also combine to give them a continued high economy. Heating tests show that they will run continuously with but slight increase in temperature, and even with a momentary overload of 100 per cent. little or no sparking is noticeable. In cases where a number of these motors are required to meet special conditions, the standard construction and wiring are susceptible of modification.

No rails are necessary with this motor. The belt is tightened by moving the motor on the lag-screws, which pass through elongated holes in the feet of the frame and hold the motor in place.

One feature of advantage is the possibility of placing it in almost any position with no greater change than the turning of the bearings to suit the position selected. The "C A" motor may be installed on the floor or be suspended from the ceiling, be set on a shelf or attached to a wall. In every case the oil collar is at the bottom of the bearing.

The one horse power (Fig. 1) and one-half horse power (Fig. 2) "C A" motors are designed for 115, 230 and 500-volt circuits; the one-eighth horse power (Fig. 3) size is for 115-volt circuits. The floor space for the first named is only 22⅛ inches by 16½ inches, and for the one-half horse power motor 18⅝ inches by 13 inches. The motors are finished in black, with brush-holders and small parts nickeled and polished.

For use with the two larger sizes a new type of rheostat (Fig. 4) has been developed. It is provided with an automatic switch which breaks the circuit in case of overload and effectually protects the motor armature. The smaller sizes are series-wound and require no rheostat.

Diesel's Caloric Motor.

The work of Rudolf Diessel in the development of the caloric motor at Munich is attracting much attention in engineering circles. These investigations formed the subject of an interesting article in the Western Electrician of November 6, 1897, which may now be supplemented by the following facts:

In the Diesel motor it is claimed that pure air is compressed in the cylinder, thus generating a temperature of about 600 degrees C. The fuel to be used, such as gas, petroleum or powdered coal, is injected into the compressed air, where it is gradually and completely burned up at a much lower temperature than ever before accomplished. During combustion and during the succeeding expansion, it is entirely turned into work. The injection and combustion of the fuel take place as the piston in the cylinder begins its return stroke. It ceases when it has reached about one eighth or one-sixth of its way back and it is so regulated that the increase in the temperature created by the compression of the air and subsequent combustion of the fuel, is reduced by the cooling off due to the work done during the succeeding expansion. Thus, practically, there is no increase in sensible heat, since the heat caused by the combustion of the fuel is immediately turned into power, and the motive power thus gained

is only reduced by the small amount required for the compression of the air.

The construction of the Diessel motor is much simpler, and therefore subject to less repairs, as, in comparison with the ordinary gas or oil engines, no igniter, gas atomizer or mixer is necessary, while compared with steam engines, no boiler, condenser or coal bunkers are required, an advantage which can hardly be over-estimated in steamship building. The injection and combustion of the fuel can be regulated automatically according to the power required, and changes in the load of the motor are governed to a nicety. The motor can be set to work without loss of time, since, once operated, it is again started by simply opening a valve admitting the stored compressed air into the cylinder. It runs almost noiselessly and without shock or jar, and in this differs materially from the best existing gas or oil engines. The interior parts will not soil, as the fuel used is completely consumed, which is shown not only by a chemical analysis of the waste gases, but also by their absolutely odorless escape into the air.

Thus far the fuel used has been mainly petroleum, but it has been demonstrated that common illuminating gas is a perfect material for this purpose, and the use of producer gas at American prices would, it is estimated, furnish power at one-half the cost of the steam generated with coal.

Expert commissions have been sent to Augsburg, where the motor has been in actual operation for fully a year, and their unanimous testimony gives the general verdict that its advent must be hailed as the beginning of a new chapter in the application of heat as a motive power. At Nuernberg, Diessel's motors are being built at present for street cars and general railroad work.

The Diessel motor rights for the United States and Canada have been acquired by a company incorporated under the laws of New York state as the Diessel Motor company of America, with offices at No. 11 Broadway, New York.

Large Three-phase Lighting Station in Boston.

The Boston Electric Light company has concluded a contract with the General Electric company for the equipment of its great generating station, now in course of erection. Up to the present this company has operated a number of stations throughout Boston. Two of these, however, have recently been abandoned to make way for the new railroad stations now being built, and the company has, therefore, decided to consolidate all the small stations into one mammoth generating plant to be erected in South Boston.

The system will involve the use of the three-phase alternating current, selected on account of its greater flexibility and the fact that by its use the value of the present distributing system will not be diminished. The dynamos will be four in number, each of 1,500 kilowatts, with a reserve capacity of 50 per cent., giving a total output of 12,000 horse power. They will be of the revolving-field type—a type adopted to permit a high voltage to be taken directly from the dynamo to the wires without the use of transformers to increase the pressure. The revolving field on each dynamo will be mounted on the shaft of an engine, and the voltage of the generated current will be 2,200 volts. To excite these dynamos, two smaller ones, each of 100 horse power, driven by synchronous motors, will be provided. In addition 18 large synchronous motors, each of 200 horse power, will drive 36 arc-lighting machines. Each motor will be set between two Brush 125-light arc dynamos, the shaft of the motor armature being extended to become the shaft of the armature of the arc dynamos. The power transmission for this arc lighting plant, therefore, will be confined to the width of the dynamo room. If this system were not employed small engines would have to be used, whereas by the method selected only the large main engines will be employed.

For the power circuits, that is for the stationary motors, two rotary converters, each of 500 kilowatts, or 650 horse power, are included in the contract. These will take the three-phase alternating current and convert it into direct current at about 550 volts. For the incandescent lighting system, the three-phase current wires will simply be connected to the existing network, using the transformers now in use.

Portable Acetylene Lamps.

A new factory, now being built on the property of the Niagara Falls Power company at Niagara Falls, is to be used for the manufacture of portable lamps, in which the fuel will be acetylene gas generated from carbide stored in cartridge form in the lamp. When the lamp needs "refilling" all that will be required will be to take out the old cartridge and insert a fresh one. The carbide for charging these cartridges is to be obtained of the Acetylene Light, Heat and Power company, whose plant is situated close by the new factory, so that there will be no expense of transportation from one plant to the other. The factory building [illegible] of frame, two stories high and 50 by 100 feet at the foundation. It is being erected by the Electro-gas company of New York for another body of men, who will put the experiments and theories of the first mentioned company into practical use. It is understood that experiments extending over a period of several months have been made in burning acetylene in all styles of lamps, from those used for household purposes to the bicycle and carriage lamp, as well as lanterns, and that the experiments have been successful.

New York Electrical Exhibition.

Following is a list of exhibitors who have secured space for the electrical exhibition at Madison Square Garden during the month of May:

Armorite Interior Conduit company........Pittsburg, Pa.
American Rheostat company............Milwaukee, Wis.
American Electric Cold Supply company.Brooklyn, N. Y.
American Pulley company............Philadelphia, Pa.
American Watchman's Time Detector.........New York.
American Engine company..........Bound Brook, N. J.
Adams-Bagnall Electric company........Cleveland, Ohio.
Arminton & Sims company...........Providence, R. I.
American Electrician company...............New York.
American Electrical and Maintenance company.......New York.
American Electrical Works............Providence, R. I.

Bullock Electric company...................New York.
Bossert Electric Construction company......Utica, N. Y.
Baylis company, The........................New York.
Bernard, E. G..............................Troy, N. Y.
Borne-Scrymser company.....................New York.
Belknap Motor company..................Portland, Me.
Brewster Engineering company...............New York.

Crocker-Wheeler Electric company...........New York.
C. & C. Electric company...................New York.
Corey, R. B................................New York.
Cobo & Co., H. B...........................New York.
Christensen Air-brake company.........Milwaukee, Wis.
Card Electric company.................Mansfield, Ohio.
Cleveland Twist Drill company.........Cleveland, Ohio.
Crouse-Tremaine Carbon company........Fostoria, Ohio.
Connecticut Telephone and Electric company.......Meriden, Conn.
Crown Woven Wire Brush company........Salem, Mass.
Cook's Sons, Adam..........................New York.
Campbell Underground Trolley company...Towanda, Pa.
Camp company, H. B....................Aultman, Ohio.

De La Vergne Refrigerator company..........New York.
Diamond Electric company.................Peoria, Ill.
Diesel Motor Company of America............New York.

Edison, Thomas A.......................Orange, N. J.
Edison Electric Illuminating company.......New York.
Eddy Electric Manufacturing company...Windsor, Conn.
Electric Storage Battery company......Philadelphia, Pa.
Excelsior Electric company.............Brooklyn, N. Y.
Edison Manufacturing company...........Orange, N. J.
Edison, Jr., Thomas A......................New York.
Electrical Engineer........................New York.
Electrical Review..........................New York.
Electrical Age Publishing company..........New York.
Electricity Newspaper company..............New York.

Fisher Foundry and Machine company....Pittsburg, Pa.
Fort Wayne Electric Corporation.......Fort Wayne, Ind.
Fuel Economizer company............Matteawan, N. Y.
Fostoria Incandescent Lamp company....Fostoria, Ohio.
Fiberite company...................Mechanicville, N. Y.
Fairchild & Sumner.........................New York.

Gold Car Heating Company...................New York.

Harrison Safety Boiler Works.......Germantown Junction, Philadelphia.
Highland Chemical company..........Connellsville, Pa.
Haines company, William S...........Philadelphia, Pa.
Haring Steam-plant Equipment company......New York.

Ideal Electric corporation.................New York.
Imperial Porcelain Works.................Trenton, N. J.
India Rubber and Gutta Percha Insulating company.......Glenwood, N. Y.

Jones & Son, J.............................New York.
Johnston company, W. J.....................New York.
Keuffel & Esser company....................New York.
Kelley & Sons, B. F........................New York.
Keystone Electrical Instrument company.......Philadelphia, Pa.

Lawrence Machine company............Lawrence, Mass.
Lewis Tool company.........................New York.
Lynn Incandescent Lamp company..........Lynn, Mass.

Morris, Elmer P............................New York.
Machado & Roller...........................New York.
Mowrey & Co., P. M.........................New York.

Niles Tool Works company.......Hamilton, Ohio, and New York.
National Meter company.....................New York.
Nowotny Electric company............Cincinnati, Ohio.
National Carbon company.............Cleveland, Ohio.
Nash Gas Engine company....................New York.
New Britain Machine company.......New Britain, Conn.
New York Safety Steam Power company........New York.

Oswego Boiler Works....................Oswego, N. Y.
Otis Electric company......................New York.
Onondaga Dynamo company..............Syracuse, N. Y.

Paragon Arc Lamp company..............Boston, Mass.
Peru Electric Manufacturing company.........Peru, Ind.
Peckham Motor Truck and Wheel company...New York.
Patrick, Carter & Wilkins............Philadelphia, Pa.
Paragon Motor company......................New York.
Porter & Remsen............................New York.

Roebling's Sons company, John A.........Trenton, N. J.

Safety Insulated Wire and Cable company....New York.
Stephenson company, Limited, John..........New York.
Silex Insulation company...................New York.
Sprague Electric company...................New York.
Simonds Manufacturing company..........Pittsburg, Pa.
Sinclair, D. J.......................Caledonia, N. Y.

Translucent Fabric company............Quincy, Mass.
Thomas & Sons company, R......East Liverpool, Ohio.

United States Electrical Supply company.....New York.

Vacuum Oil company...................Rochester, N. Y.
Van Horne, Burger & Co.................Dayton, Ohio.

Worthington, Henry R.......................New York.
Walker company.......................Cleveland, Ohio.
Weston Electrical Instrument company...Newark, N. J.
Warren Electric Manufacturing company.Sandusky, Ohio.
Williams & Co., J. H...................Brooklyn, N. Y.
Wendell & McDuffie.........................New York.
White, J. G., & Co.........................New York.
Western Electrician..........................Chicago.
Worthington Water-tube Boiler..............New York.

Zundars & Hunt.............................New York.

Electrical Interests of Texas and Mexico.

As already announced in the Western Electrician, there will be a joint meeting of the Texas Gas and Electric Light association, the Texas Street Railway association and the gas, electric and street-railway men of Mexico, at Laredo, Texas, beginning March 9th and continuing until March 12th. This will be the fourth annual meeting of the lighting association and the fifth annual meeting of the street-railway association. The fact that it will be an international meeting and will be largely attended by those interested in gas, electricity, street railways and related industries in both countries gives it unusual prominence and importance, not only to those directly interested in the business, but also to all who desire to protect and advance the trade relations and mutual interests of the two nations.

The opening session will be a joint meeting at which addresses of welcome and responses will be made and the work of the associations outlined. Separate meetings of the organizations will be held on the following days, at which papers prepared by members will be read. The evening sessions will be joint meetings, and at each of these a lecture on a subject of general interest will be delivered.

Among the papers to be read before the street-railway men will be one by H. C. Chase of Houston on "Rail Bonding as a Power Saver." There are several announcements of special interest to electric-lighting interests. The subject of "Meter vs. Flat Rates" will be discussed by J. R. Cullinane of Denison. "Uniform Voltage and Continuous Service" is the title of a paper promised by George R. Cushman of San Antonio, and "Rates for Electric Lighting" will be considered by E. L. Wells, Jr., of Marshall. At the first evening session Harry L. Monroe of Dallas will read a paper on "Use and Abuse of Electrical Machinery, Apparatus and Appliances," and the second evening will be occupied by J. D. Cox of Galveston, who will present a paper on "An Electric Furnace, Calcium Carbide, Acetylene Gas and Other Forms of Gas."

Several excursions will be made to coal, silver and gold mines in the vicinity and to Monterey, Mexico, and on Sunday, March 13th, it is announced that those who desire may see "el Toro" in the afternoon. An "international banquet" has also been arranged.

It is stated that the Mexicans who are connected with the lighting, street-railway and power plants of the Republic of Mexico have evidenced great interest in the proposed meeting and that the Mexican government has, through its Department of Foreign Affairs and through Senor P. Ornelas, Mexican consul at San Antonio, expressed interest in and tendered offers of assistance, as far as possible, for a successful meeting. A large attendance is expected from Mexico. It is promised that hotel accommodations will be ample and that a large and convenient hall, with light and power service, will be available for exhibits. Charles F. Yaeger of Laredo, Texas, is the chairman of the local committee of arrangements, and Carl F. Drake of Austin, Texas, is the chairman of the committee on transportation.

City Ownership of Street-railway Lines.

According to a London correspondent, Sir Bosdin Leech has vindicated the policy of tramway municipalization in an exhaustive paper read before the Statistical society of Manchester, where the City Council has decided to adopt electric traction and to operate all tram lines after 1901. The principle of the municipal operation of tramways is now regarded by reformers as on a level with corporation ownership of water, gas and electric supplies, and, according to the same writer, it has proved a successful experiment wherever it has been tried.

A great impression was produced by the paper by Mr. Philip Dawson on electric railways read before the Institution of Mechanical Engineers. He contrasted the mileage of electric railways in the United States and the United Kingdom, the figures being 12,583 against 167, and explained that private enterprise was not restricted in the one country by legislation, whereas it is paralyzed in the other. Municipal councils are finding out they are behind the times and are rushing to electric traction with overhead wires, whereas they might easily get a better system by sending experts to Budapest.

A Great Electrical Undertaking in New York.

Dr. Louis Duncan of Baltimore has been appointed consulting electrical engineer to the Third Avenue Railroad company of New York city. It is said that the company intends to adopt electric traction on all of its existing lines and on others to be built. The improvements contemplated will cost several millions of dollars.

Fighting the Western Union's Mexican Contract.

The railroads of Mexico have filed a strong protest with the Mexican government against the contract recently entered into between the Western Union and the Federal Telegraph company and the federal government giving the Western Union exclusive control of the international commercial tele-

graph business of that country. The railroads say that this contract is a violation of their respective concessions. The Western Union service in Mexico was to begin on January 5th, but was postponed pending a decision from the government.

Death of J. H. Rhotehamel.

James H. Rhotehamel, the president of the Columbia Incandescent Lamp company of St. Louis and one of the leading lampmakers of the country, died on Thursday morning, February 17th, after a brief illness. The sad news comes to Chicago as the Western Electrician is going to press, and full particulars of Mr. Rhotehamel's illness and death are not attainable at this writing. Mr. Rhotehamel was about 42 years of age and a native of Ohio. He had been prominent in the incandescent-lamp industry for the last 10 years, and he built up a large business. At the time of the prosecution of the infringement suits on the Edison incandescent-lamp patent several years ago, Mr. Rhotehamel made a vigorous fight against the claims of the General Electric company, on behalf of his company, and brought forward the celebrated Goebel defense, which, in his case, was successful. He was widely known in electrical circles all over the country and was active in all concerted movements of the branch of the industry with which he was connected. His death will be sincerely regretted. The deceased leaves a wife and an infant son.

Death of H. W. Johns.

Henry W. Johns, known to the electrical trade by the insulation and insulating devices made by the company bearing his name, died at his home at Park Hill, Yonkers, N. Y., on February 8th, after an illness of several months. Mr. Johns was born in West Stockbridge, Mass., in 1837, and at an early age came to New York, engaging for a short time in various lines of business before entering upon that which was to be his life work. In 1858, while experimenting with a view to perfecting a fireproof compound, he learned of the existence of asbestos, an indestructible fibrous mineral, at that time but little known outside of laboratories and mineralogical collections. From this time until his death he worked continuously at the development of its commercial uses, and built up a large business based upon his numerous inventions. Mr. Johns was president of the H. W. Johns Manufacturing company and of the Johns-Pratt company of Hartford. He was also at one time a director in the Western National Bank of New York.

COMMUNICATION.

Alleged Infringement of Lamp Filament Patent.

To the Editor of the Western Electrician:

As there has lately been some accounts in the newspapers referring to the matter of our having been sued by the trust for alleged infringement of what is known as the Weston patent, which is a patent on the cellulose filament, we request that if you are going to take any notice of the matter, you at least favor us with a fair statement of the case.

Of course you will understand that the suit is one of the suits that are instituted by the trust against all lamp manufacturers who decline to enter the trust or pay a license to it. The alleged infringement of their patent, we are confident, we can successfully defend, the filament used by us being one that is covered by good patents.

We have had good counsel on the matter, both since the suit was instituted and before we engaged in the manufacture of lamps, and are satisfied in our ability to defend our position.

We have no objection to the matter being published, but would be obliged to you if you would state our side of the case.

K. & W. COMPANY.
F. R. Whittlesey, Treasurer.

Pittsfield, Mass., February 15, 1898.

CORRESPONDENCE.

New York Notes.

New York, February 15.—A curious fatality was that by which Winfield S. McDowell, an electrician, lost his life a week ago to-day. Mr. McDowell was not in the employment of any electrical company, but worked for himself, putting in wires or repairing breaks wherever he could find a job. He was doing some work under the sidewalk of the building at 40 and 42 Broadway, and the police think he was trying to tap the telegraph wires under Broadway for the benefit of some poolroom or bucket-shop, when he met his death. No one could be found to admit knowledge of his presence, and yet he had been working in the sub cellar which abuts on Broadway long enough to cut a hole two feet square in a retaining wall 16 inches thick, and made of undressed stone and cement. There are two retaining walls between the sub-cellar and the street, and a space of over three feet between them is filled with tightly-packed sand. McDowell cut a hole through the first wall, but evidently knew nothing of the existence of the outer wall, for he was trying to drive a two-inch iron pipe through the sand to what, it is presumed, he thought was the conduit which holds the wires which run under Broadway. The pipe struck against the outer wall. Not knowing what the obstacle was, he decided to investigate, so making a tunnel in the sand large enough for his body he crawled into the hole. The sand, loosened by the tunnel he had made and by the jar of pedestrians on the sidewalk overhead, came tumbling down upon him. Caught as he was in the hole, with the weight of the sand on his head and body, he was unable to extricate himself and was smothered to death. The first that was known of his death was when the engineer of the building, coming, it is said, to inspect the tank which supplies the water for the elevator, and which is situated in front of the sub-cellar, saw the man's feet sticking out from the hole in the wall. He called for assistance, and the body was pulled out. All the employes in the building denied emphatically that they knew the man was at work. The dead man lived in Flatbush and leaves a widow and two children.

President Gould, of the Manhattan company, has asked for a conference with the Rapid Transit commissioners, and the meetings will be arranged, but it is not expected that the discussion will be made public until a final report is made. George J. Gould, Robert M. Gallaway, Russell Sage and Marcellus Hartley will represent the Manhattan directors. "This committee," says Mr. Gould, writing to the commissioners, "will furnish your board such further definite and specific information as may be possible, and as speedily as it can be prepared by our engineers, on the following matters referred to in your letter: (1) A detailed description of the structures to be located on the proposed routes, (2) the time within which the connecting and extending railways and additional tracks and facilities will be constructed, (3) the grade of the proposed crossings, and (4) definite information on all other points which may appear to your board and this company to be pertinent to the matters under consideration, or which can in any manner facilitate your board and expedite action on the application now pending." It will be observed that no direct reference is made to the electrical equipment of the elevated system.

Counsel for the Rapid Transit Commission appeared before the Appellate Division of the Supreme Court on Friday to move for a reargument of the motion for the confirmation of the report made by the Supreme Court commissioners favoring the construction of the underground railway. Opposing attorneys appeared to represent property owners who object to the construction of the tunnel. There was no argument in the case, counsel merely submitting briefs, which were taken by the court, decision being withheld. The lawyers for the Rapid Transit Board ask that the $15,000,000 bond stipulation be modified.

John Sabine Smith, one of the three special commissioners appointed by the Supreme Court to inquire into the feasibility of the Rapid Transit commissioners' tunnel plans, has made a motion before the Appellate Division asking that it grant compensation to the three commissioners. He asked for an allowance of $15,000 each. The other commissioners are Arthur D. Williams and G. W. Young. Decision was reserved.

The committee on rapid transit of the Real Estate Exchange reaffirms its position by asserting its belief that true rapid transit can only be obtained by the construction of a four-track underground railroad, but it suggests that the Rapid Transit commissioners give consideration to the immediate necessity of granting some relief through the existing elevated railroad. M. S.

Washington, D. C.

Washington, February 15.—The District commissioners have completed the draft of an electrolysis bill on which they have been working and have been working and have transmitted it to Congress. The bill provides for the regulation of the laying and grounding of underground electric-light and power wires, and the construction of trolley systems. Captain Burr, assistant to the District engineer, submitted a report with the bill on the subject of electrolytic action on pipes, etc., underground in the streets of the city. In this report Capt. Burr declares that with the large increase of late years in the use of electricity for lighting and power purposes, the damage resulting to underground metallic constructions from the use of the ground or uninsulated returns has greatly increased, and the evils from such an incomplete system of distribution for electricity are beginning to be fairly realized. With the absence of overhead trolley roads in the city of Washington the question of electrolytic action has heretofore been an unimportant one. Conditions, however, have changed so markedly within the last two years that it should have immediate attention. "Recently," continues the report, "a large central-power station has been established within the city limits from which nearly all the trolley roads in the District and some in Virginia and Maryland obtain their power. This station also furnishes current for private and public lighting at various points within the District. Current so generated is constantly delivered to many points, some of which are a number of miles distant. In many instances this current has to find its way back to the station through the ground and such metallic construction in it as offer the least resistance, no proper metallic return having been provided." After summing up the conditions existing among the electric roads in the District very exhaustively, the bill is reported, which provides that each street-railway company in the District using the single overhead trolley system, or using any other electrical system, employing an uninsulated, a grounded, or a rail return or feeding circuit for the current, shall equip its lines with the double-trolley system, or other equally good insulated metallic-circuit system, subject to the approval of the commissioners, sixty days from the date of passage being allowed for the filing with the commissioners of plans of the new system to be employed. Three months after the approval of the plan the company shall fully carry out its requirements. A penalty of $25 a day is fixed for non-compliance with the law. The second section of the proposed act makes it unlawful for any person, company or corporation in the District to furnish current for electric light, heat or power, on a circuit or system, any portion of which is grounded or connected to any grounded construction, or which is not thoroughly insulated from the ground. It shall also be unlawful for anyone to operate an electrical generating or transforming machine, any pole or terminal of which is grounded or connected with a grounded construction. Thirty days are given for the filling of plans of changes, and 60 days allowed after the approval of the plans by the commissioners for their proper execution. The penalty is the same as in section 1.

An amendment to the District appropriation bill provides that the sum of $60,000 be appropriated for electric arc lighting, including necessary inspection for the streets of the city of Washington.

The Senate sub-committee in charge of street railways has reported the bill to authorize the installation of the underground system of electric propulsion for the Eckington and Soldiers' Home railroad.

President Crosby of the Potomac Electric Lighting company has asked for an extension of the time when overhead wires may be used west of Rock Creek. As the people of that vicinity are dependent upon the Potomac company for electric lights, it is thought that the request may be granted.

The bill to authorize the Washington and Glen Echo Railroad company to obtain a right of way, etc., has been reported adversely, and postponed indefinitely.

The annual report of the president of the Columbia Railway company of the District of Columbia states that the total receipts during the year 1897 were $168,721.03. The total operating expenses during the year were $171,866.58. The total receipts of the Washington and Great Falls company for the year were $49,733.74, and the total disbursements $47,188.29. The total receipts of the Georgetown and Tennallytown Railroad company were $38,336.15, and total expenditures, $38,336.65.

The public printer has been authorized to place one six-pin cross-arm on each of 11 poles now erected on North Capitol street, between G and B streets, and to string thereon six telephone wires for use between the Government Printing Office and the United States Senate and House of Representatives.

The Electric Railway Equipment company of this city has been granted a charter. Mr. A. C. Greenlees of Washington is the president, and the capital stock is placed at $100,000.

The expenditures of the Postoffice Department for electric light and gas lighting during the last fiscal year were $3,703.68; the appropriation was $5,250; therefore the amount unexpended by the department was $1,346.32. The department expended $2,417.26 for telegrams, with an unexpended balance of $82.74.

According to Public Printer Palmer's report for the fiscal year, during that period there was expended for light, in the Government Printing Office, $2,262.97 for electricity and $2,672.50 for gas. Electric supplies cost $7,232.76. T. I. P.

Northwestern Notations.

Minneapolis, February 15.—The Minneapolis Street Railway company is now using the power from the new dam to operate all the cars of Minneapolis and the Minneapolis end of the Interurban line. The Thirty-first street power house has been shut down for good, but the Third avenue north power station will be kept in readiness against any accident that may occur.

Waterloo, Ia., is being canvassed in the interest of a co-operative electric-light system. The estimated cost of a plant is $10,000.

The Citizens' Electric Light company of Lewistown, Mont., has been incorporated with $10,000 capital stock to put in an electric-light plant.

The Minneapolis General Electric company will abandon the power station in the Edison building, Minneapolis, and use it only for a distributing point. All the power now comes from the station at Third avenue southeast and the river.

Patrons of the electric-light company at Albert Lea, Minn., held a meeting to complain of the service and the way the meters worked. It was alleged that sometimes the meters failed to register when the light was used and other times they registered when there was none used. There is some talk of a municipal electric-light plant for the city.

The electric railway of Ottumwa, Ia., will be sold at auction on a mortgage of $236,000, by order of the federal court. The plant cost $425,000 to $500,000, and includes a street-railway system. Under the management of Receiver Merrill the expenses have been reduced until the plant is on a paying basis.

Sheboygan, Wis., wants railroad connection with the Chicago, Milwaukee and St. Paul at Random Lake, and the Advancement association has been agitating it. John M. Saemann has now made a proposition to give not only connection for steam cars, but also to operate an electric-car line between these points, if given a bonus of $45,000. The estimated cost of the line is $335,000 to $340,000. He proposes to put on heavy motors, to run at a speed of 45 miles an hour, and make hourly trips.

The contract of the city of Des Moines, Ia., with McCaskey & Holcomb for the construction of an electric-light plant has been declared void and the election which authorized it illegal, for the reason that the two propositions were contradictory.

The Appleton Electric and Power company of Appleton, Wis., is preparing to make some improvements to its power house. New water wheels will be put in and the flume straightened and improved. The changes are to be completed by April 1st.

Christian A. Stengle, an old telegraph operator, died suddenly at his home in Minneapolis recently. Stengle was the first operator to receive a telegram in Sweden in the early '50's. He was nearly 40 years an operator, and was finally retired on a pension from the government, which operates the telegraph lines in Sweden. He has lived in Minneapolis about 10 years.

The street-railway company has abandoned the attempt to get together with the council of St. Paul to secure an ordinance to run express trains between Minneapolis and St. Paul. The company will now endeavor to secure an ordinance for changing the Selby avenue cable into electric and for the Como Park line to Minneapolis. To these it is understood the council has no objection.

Charles C. Deering and C. C. Wells have formed an electrical firm in Boone, Ia.

The aldermen of Casselton, N. D., have decided on a rate of 40 cents for 16 candle power incandescent lights, and will make special rates for hotels, lodge-rooms and churches. This is looked upon by many as too low a rate to operate the plant profitably.

There is talk of putting in an alternating system of lighting at Springfield, Minn. The present system is overloaded and is an incandescent system on an arc plant, which is unsatisfactory.

The North American Telegraph company held its annual meeting in Minneapolis a few days ago. Clinton Morrison was elected president; W. R. Merriam, vice-president, and H. A. Tuttle secretary and general manager. H. F. Brown declined to be re-elected as treasurer, and E. C. Cook was chosen. A semi-annual dividend of 2½ per cent. was declared.

J. J. McGeehan, a prominent logger of Ashland, Wis., is about to put in an electric-light plant at Orienta, Wis., to enable him to raft and sort logs by night. Incandescents will be used in the sorting pond and arcs in the bay.

A fender on a street car in Duluth, Minn., recently saved a small boy's life. The youngster was sliding down a steep hill and met the car also coming down, both going at a good speed. It was impossible for the motorman to stop the car and the boy was struck by the fender and picked up. He was carried a few feet, but sustained no injuries whatever.

J. A. Brown of Moline, Ill., is negotiating with Fairfield, Ia., citizens with a view to starting a factory there for the manufacture of electrical supplies.

M. H. Gerry, Jr., of Minneapolis, an electrical engineer, has opened the cabinet in connection with the Bankers' Electric Protection company's system, without sounding the outside gong. Gerry examined the device, which has been put in several local banks, and said he believed he could open the cabinet door enclosing the vault door without setting off the alarm. The bankers desired a thorough test and allowed him to examine the system from all points, and after becoming familiar with it, to test it. He strung wires to cut off the door, and, after 30 minutes' work, unlocked and opened the cabinet door. The bankers feel that he had chances to get at the device that no burglar ever could and had everything in his favor. They are convinced the system is the nearest approach to perfection that has been discovered.

C. G. Edwards, manager of the electric-light plant of Albert Lea, Minn., has invented a device for attaching and detaching electric lamps from sockets. The device is arranged so that it can be extended almost any length, and will be of great use in churches, theaters, halls and any high room in removing dead lamps, where the height is such that a ladder is not available. A number of orders have already been placed, though there has not been any effort to make sales. The application for the patent is now pending.

The Chippewa Valley Electric Railway company is arranging to construct a line between Eau Claire and Chippewa Falls, Wis., in the early spring.

The Patton system is to be used for a line between Grundy Center and Waterloo, Ia. C. W. McElyea, who has put in a line at Cedar Falls, will construct the system. It is proposed in time to extend the line to Eldora, Nevada and Des Moines.

It is suggested at Fairmont, Minn., that an electric-car line be constructed to Armstrong, Ia., to connect with the Burlington railroad.

The Park Board of St. Paul has selected a route for another interurban car line to Minneapolis, through St. Anthony Park, via Langford avenue. It is to go through Como Park, St. Paul, and will be built as far as possible to avoid surface crossings in the park.

The Seattle (Wash.) City Railway company contemplates reconstructing its line along Yesler way and changing its power house to another location.

Minneapolis aldermen are inclined to be a little dubious over the value of street sprinkling from street cars, in accordance with a proposition recently made.

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PERSONAL.

C. J. Sturgeon, manager of the electric department of the Erie City Iron Wroks, Erie, Pa., passed through Chicago this week.

The Atlanta (Ga.) Consolidated Street Railway company has elected Ernest Woodruff president to fill the place formerly held by Joel Hurt.

C. D. Crandall of the Western Electric company of Chicago is enjoying a southern trip. Mr. Crandall will probably visit several points in Mexico before his return.

ELECTRIC LIGHTING.

The Hampton (Va.) and Old Point Gas and Electric company has been incorporated, with capital stock of $75,000, to furnish illumination.

Contract has been awarded to the Fort Wayne Electric corporation by the city of Grafton, W. Va., for the erection of an $8,600 lighting plant.

The city of Albany, Ga., contemplates the purchase of the Albany Illuminating company's plant and the expenditure of $5,000 on improvements.

W. J. Hoffman and J. K. Wright have a franchise to light the town of Chestertown, Md., and will erect an electric plant at a probable cost of $15,000.

The citizens of Rogersville, Tenn., have voted adversely in the election for erection of electric-light and water works, but a franchise may be granted to a company. Mayor H. J. Nelson may be addressed.

The City Council of Hot Springs, Ark., has in consideration the establishment of electric-light and water-works. If definite arrangements are made, the Board of Public Affairs will have the matter in charge.

The Catonsville Ice, Light and Power company of Catonsville, Baltimore, Md., will probably arrange with the Ellicott City Council for lighting the city. A plant to cost $40,000 will be erected in the event of the proposed arrangement being completed.

B. B. Linehan, the vice-president of the Star Electric company of Dubuque, Iowa, has by purchase acquired all the stock of that company. The company was incorporated in 1892 with a capital stock of $100,000. It is said that Mr. Linehan will add a steam-heating department to the business.

The Washington County Electric company of Hagerstown, Md., has been incorporated by Christian W. Lynch, William Jennings, of Harrisburg, Pa.; J. Clarence Lane, J. Irvin Bitner and William Hepperle, of Hagerstown. The company has applied for franchise, and will erect a lighting and power plant.

ELECTRIC RAILWAYS.

In consideration of $300 cash and the additional sum of $1,200 to be paid in two years, it is said that the trustees of Lake Bluff, Ill., have given the Bluff City electric railway five months more in which to lay its track. The company's franchise would have expired on February 7th had it not been for the extension.

Receiver MacAllister has now been in charge of the Metropolitan Elevated road of Chicago for over a year, and his report shows that from January 20, 1897, to February 1, 1898, the gross income was $953,624 and the total disbursements $723,432, leaving a cash balance of $230,192. The report also shows that before the Metropolitan could use the Union Loop the average daily passenger traffic was about 40,000, while now it is about 64,000.

The bill for the amendment of the charter of the Capital Railway company of Washington has been reported back with the further amendments for the use of a double overhead trolley system on the Navy Yard bridge and that, within one year after the passage of the act, the lines west of the Navy Yard bridge must be installed with an underground electric system similar to that now in use by the Metropolitan railroad, and any portion not so equipped may be forfeited at the expiration of the time named.

By the terms of ordinances passed by the Cicero Town Board last Saturday, Cicero will soon boast of an elevated road and five-cent fare to Chicago's business center. The ordinances are known as the Cicero and Harlem and Cicero and Proviso extension ordinances. The first gives the newly incorporated company the right to build an elevated railway from Fifty-second to Harlem avenue on Lake street and South boulevard, and provides that passengers may be carried to any point on the Union Loop for a five-cent fare. The second gives the Cicero and Proviso railway an extension of its franchise for 50 years and provides for a commutation rate to the city of 12 rides for $1. The elevated road, according to the ordinance, must be completed by July 15th, while the other ordinance does not take effect until the Lake street road is completed.

The great snowstorm of January 31st which raged over New England has proved that a railroad can be operated by the third-rail electric system under the most adverse conditions. That portion of the New York, New Haven and Hartford railroad between New Britain and Hartford operated by electricity, was kept open during the whole of that day and the trains were run with but few seconds' delay in the schedule; while the steam trains on the main lines were delayed for three or four hours. A heavy snowstorm had long been desired by the electrical engineers and railroad officials in order that as severe a test as possible might be applied to the third-rail system. It has been a question, whether, with the third rail practically surrounded by snow and moisture, current would be obtainable in sufficient quantity to furnish the necessary power to operate the cars. This question was settled satisfactorily by the snowstorm.

It is said that Tom L. Johnson has parted with his Big Consolidated Street Railway stock. When the Big Consolidated was organized Mr. Johnson's holdings amounted to $1,500,000. He was one of the organizers of the road, the official name of which is the Cleveland Electric Railway. Johnson has been selling off stock ever since the fall election. About two months ago he began selling his holdings in large blocks, and since then has sold 8,000 shares. He had no broker, but sold the stock direct to the investors. About 10 days ago Johnson sold a block of 1,000 shares to one of the present directors of the company. This transaction became known, and a prominent banker, thinking the stock was low, called on Johnson and discovered that he had in the neighborhood of 3,000 shares left. The banker bought the stock at what he considers a low figure. Mr. Johnson is also said to be withdrawing from the Johnson Electric company of Cleveland and Lorain, Ohio.

The Lake Street Elevated Railroad company of Chicago has accepted the ordinances passed by the Cicero town board, and work on the Lake Street Elevated extension will be pushed forward and will be completed by July 15th of the current year. The extension ordinance for the Lake Street company was granted to the Cicero and Harlem company in order to avoid any entanglements with the Lake Street Elevated litigation. The Lake Street Elevated will be continued one mile west to Taylor street. From that point the track will incline about 1,400 feet until the surface is reached. The surface extension will run to Harlem avenue, making a total extension of 2½ miles, over which a single fare of five cents will be charged to the city. The train service will, of course, be continuous. The regular elevated coaches will be run over the surface line by means of an overhead trolley system and he operated on the third-rail plan when the elevated structure is reached.

Judge Wickes of Baltimore has signed a decree for the sale of the Columbia and Maryland railroad, the proposed electric railway between Baltimore and Washington. The road has been in the courts under various forms of litigation for some time. Messrs. Widener and Elkins and others of the traction syndicate were at one time interested in it. Nicholas Bond is to be continued as receiver. William L. Marbury, as trustee under the first and second mortgages, will conduct the sale. The properties included are controlling interests in the Belt Railroad and Soldiers' Home railway, both of Washington; the Maryland and Washington railroad, stock and bonds of the Catonsville short-line steam railroad, power houses, etc. It is said that the Baltimore Security and Trading company has liens on the properties to the extent of over $2,000,000. The road is completed from Washington to Laurel. A company of New York, Philadelphia and Baltimore capitalists will, it is understood, be formed to buy the several lines and organize a new company.

Referring to the recently published statement that the Chicago, Milwaukee and St. Paul Railroad company has decided to operate its suburban trains in and about Chicago by electrical power, the Railroad Gazette has this to say: "As a matter of fact, the St. Paul has for a good while been making careful investigation into this matter with a view to 'electrifying' the Evanston division. According to the plan this will be worked in connection with the Northwestern elevated, and thus the suburban trains of the St. Paul will be brought directly into the heart of the city over the Union Loop. Such an arrangement would be an extraordinary and we should suppose popular and successful arrangement

for handling suburban traffic. Indeed, it would be the nearest to the ideal arrangement of anything that has yet been installed. We believe it to be quite true that this is likely to be carried out, but inasmuch as the Northwestern elevated cannot be finished for something like a year, and inasmuch as the money for finishing that road does not seem to have yet been provided, the complete working out of this scheme may be delayed some little time."

Articles have been filed for the organization of the LaGrange, Warrenville and Fox River Electric Railroad company. It is proposed to construct and operate an electric railroad from LaGrange Park in Cook County, Ill., westerly through Fullersburg and Warrenville, in DuPage County, to Fox River in Kane County, with branches to Proviso, Center and Western Springs, in Cook County, and to Hinsdale, Lombard, Downer's Grove, Glen Ellyn, Naperville, Wheaton, Bloomingdale, Roselle and West Chicago, in DuPage County, and to Batavia, in Kane County, and branches from the main line to other points between the DesPlaines River in Cook County and the Fox River in Kane County. The capital stock is placed at $100,000, and the principal office is to be maintained at Chicago. The incorporators and first board of directors are George W. Waite, A. C. Allen, M. C. Covell, A. H. Kenman, Frederick Poulsen, J. W. Krueger and Edward S. Ely, all of LaGrange; James M. Vallette, B. B. Boreker, I. N. Murray, Willard Scott, George Remps, C. L. Schwartz of Naperville, William J. Manning, John McKee, A. T. Jones of Warrenville, Henry W. Grote, J. J. Cole, Ira Brown, Elbert H. Gary and George W. Brown of Wheaton, George W. Wilson of Hinsdale and J. M. Vallette of Naperville.

The Supreme Court of Connecticut has decided that the appeal of the New York, New Haven and Hartford Railroad company from the decision of Judge Wheeler of the Superior Court in the matter of the building of the Shelton electric railway cannot be allowed. The work will now be pushed forward as rapidly as possible, and before the summer is over Bridgeport and Ansonia and other towns up the Naugatuck Valley will be connected by trolley lines. This attempt to parallel the system of the Consolidated road has led to much litigation, and the case has twice been in the Supreme Court. On the first hearing the Consolidated road secured a victory. Judge George W. Wheeler laid down the principle that a road which desired to build must show its financial ability to do so. The Supreme Court sustained this opinion. The matter then came up again before Judge Wheeler, and the street-railway company showed to the judge's satisfaction that it was in good financial condition and able to build the proposed extension. The attorneys for the Consolidated road gave notice of an appeal, asserting that Judge Wheeler had not found in accordance with the decision rendered by the Supreme Court on the previous hearing. The steam railroad is beaten on a technical point in taking the appeal. Counsel for the street railway filed a plea of abatement against the jurisdiction of the court, saying that the appeal is fatally defective because it failed to give the term to which the appeal was taken and the time of the meeting mentioned. Two decisions of the Supreme Court of recent date were quoted to sustain this view.

TELEPHONE.

The Citizens' Telephone company is being organized to establish a system at Columbia, Tenn.

The Macon (Mo.) Telephone company has been incorporated by H. L. Gray, J. A. Hudson and Theo. Gray. The capital stock is $10,000.

It is asserted that the Bell Telephone company will appeal to the courts unless North Carolina's State Railroad Commission restores the old rates.

Franchise for a telephone system has been secured by J. A. Helvin, at Charlotte, N. C., and it is probable that the construction of the plant will be commenced soon.

The Western Maryland Telephone company of Westminster, Md., will issue bonds for $8,000 to provide funds for extending its telephone lines to Baltimore; John M. Reifsnider is the secretary.

The Haskell and Throckmorton Telegraph and Telephone company has filed its charter, the capital stock being $3,000. The purpose is to construct and maintain telegraph and telephone line between Seymour and Haskell, Texas. The incorporators are T. H. C. Peery, G. P. Barber and G. S. Plants.

The Union Telephone company has been organized in Portland, Me., for the purpose of acquiring and operating telephone lines and dealing in telephone and electrical supplies. The papers of incorporation call for a $10,000,000 capital stock, of which $300,000 is paid in. The officers are: President, Frederick H. Gorman of New York; treasurer, George A. Beaton of Detroit.

ELECTRICAL SECURITIES.

On Monday Chicago Telephone stock sold up to 204, the highest price attained in several months.

Chicago Edison five per cent. gold bonds touched 106½ last week. This is the highest price noted. The business of the company is in a very satisfactory condition.

The Columbus Street Railroad company reports gross earnings for January of $53,788, an increase of $6,919 as compared with the same month of last year, and net $28,598, an increase of $5,501.

The complete returns of the Erie Telegraph and Telephone company for the year ended December 31st show gross earnings of $364,550, an increase of $49,636; expenses and interest, $137,903, an increase of $31,629, and an improvement of $18,007 over the preceding year.

Probably the increased cost of operating the Third avenue system in New York has compelled that corporation to consider electrical equipment. The gross earnings last quarter increased $36,170, but the operating expenses also increased $41,298 compared with the previous year.

The detailed statements of the Brooklyn street-railway companies for the last quarter of last year showed marked improvement. The Brooklyn Heights company's net earnings, as compared with the same period in 1896, showed an increase of $19,721, while the Brooklyn, Queens County and Suburban company's receipts were $23,371 ahead of last year's report for the same quarter.

The Bridgeport Traction company reports gross earnings for January of $26,898, an increase of $4,292 as compared with the same month of last year, and net $11,246, an increase of $3,795. For the seven months ended January 31st, the gross earnings were $200,403, an increase of $6,753 as compared with the corresponding period of last year, and net $96,719, an increase of $15,837.

First-mortgage five per cent. 50-year gold bonds of the Syracuse Rapid Transit Railway company to the amount of $1,250,000 are offered for sale at 101 and interest. The net earnings of the road for the six months ended December 31st were nearly $120,000. The reports of special experts who were engaged to make an examination of the property are particularly favorable. The company owns franchises which practically give it a perpetual monopoly of the street-railroad business in Syracuse.

MISCELLANEOUS.

There is a bill pending in the United States Senate providing that all overhead electric wires in the District of Columbia, within the fire limits, be removed within one year from the passage of the act.

Commenting on the recent storm in New England, during which a large number of horses are reported to have been killed in the streets of Boston by contact with fallen trolley wires, the London Electrical Engineer regrets the "holocaust of over 200 horses."

It is reported that a large power house will be erected in or near Kansas City for the generation of electricity to be distributed for use in packing houses, factories, on street railways and otherwise. Those said to be interested include Colonel D. A. McKibben, John M. Lang and G. W. Kierstead, all of Leavenworth, Texas.

The Acetylene Gas Machine company has plants on both sides of the river at Niagara Falls. It finds business good in its New York state branch, but on the Canadian side a peculiar restriction imposed by the Canadian fire underwriters, that two generators be attached to each machine sold in Canada, raises the cost of a plant to such a price that the sale is greatly restricted.

A bill has been introduced in the Virginia Legislature for the protection of electric lighting and power companies from theft of electric current or apparatus, or unlawful interference therewith. The measure provides that anyone intentionally preventing an electric meter from properly registering, or diverting any electric current from the wire of any company, or who shall unlawfully injure any apparatus of such company, shall be guilty of a misdemeanor and be punished by a fine of not less than $50 nor more than $200, or by confinement in jail for not more than one year, or both.

On March 3d Major Leach, the United States engineer at New London, Conn., will open bids for installing an electric light and power station at Great Gull Island, N. Y. The engine is to be a 28 horse power oil engine of the Hornsby-Akroyd type, with accessories. The generator is to be a multipolar, 15-kilowatt, direct-current, constant-potential, compound-wound, belt-connected, 250-volt dynamo. Three switchboards are required. The conductors are to be insulated according to United States navy specifications. Two storage batteries are required, each to consist of 54 chloride accumulator cells. Intending bidders desiring further particulars can obtain them upon application to Major Leach.

Mr. Edison, who developed the kinetoscope, is said to be after all the promoters of machines of the "scope" and "graph" order who do not pay tribute to him or give him credit. He declares many of them are unlawfully using the fruits of his genius. Through his counsel damage suits for patent infringement have been instituted and active preparations are under way for broadening the campaign. One of the first moves made by Mr. Edison was to begin action against the managers of a passion-play representation now running in New York. One of the mangers made a visit to Mr. Edison, and when he returned said he had agreed to pay the inventor a royalty. Mr. Edison's name will appear on the programme in token of his triumph and in warning to his opponents. It is said that the inventor's next move will be against a passion-play production in Baltimore.

TRADE NEWS.

W. W. McChesney, Jr., representing the well-known firm of Huebel & Manger of Brooklyn, passed through Chicago on a trip through the central states. Mr. McChesney has met with flattering success so far, having secured many orders for the widely-known products of his company.

The Mason Electric Equipment company, 408 Fisher building, Chicago, has secured the entire order for the overhead equipment, including trolley wire, span wire, etc., for the St. Louis, Belleville and Suburban Railway company. This contract is an important one, and the Mason company is to be congratulated on securing it.

The Davis & Egan Machine Tool company of Cincinnati, Ohio, has received through its office at Berlin, Germany, orders for a number of its screw machines, lathes, drill presses and shapers, from the Electricitaets Gesellschaft Helios of Cologne and Schuckert & Co. of Nuremburg. Both of these concerns are large builders of electrical equipments.

The plant and business of the St. Louis Electric Light and Power company have been transferred to the Missouri Edison Electric company. C. E. Delafield has moved his office to the latter company's headquarters in the American Central building, 415 Locust street, where he will personally give attention to complaints in connection with the service and look after orders for motors and power service.

The Bissell, Dodge & Erner company of Toledo, Ohio, has for three years maintained a branch office at Columbus, Ohio, where the business has assumed proportions that make it desirable to run it as a separate concern. For this purpose Mr. John A. Erner has sold his interests in Toledo and purchased the Columbus business entire. Little change will be made in either place except the names, which will be F. Bissell & Co., Toledo, and J. A. Erner & Co., Columbus. The affairs of the Bissell, Dodge & Erner company will be closed at the Toledo office.

BUSINESS.

The Central Electric company of Chicago is prepared to furnish from stock India or amber mica, cut or uncut, in rings, washers, or any other standard form, a specialty being made of standard shapes for commutators.

The General Incandescent Arc Light company of New York states that the firm of S. R. Jonap & Co. of that city, having tried a number of enclosed arc lamps made by a competitor, has replaced them by standard Bergmann enclosed arc lamps.

James L. Robertson & Sons, 204 Fulton street, New York, manufacturers of the improved Robertson-Thompson indicator for steam engines, announce that, owing to a greatly increased demand for high-grade indicator piping, they have recently added to their equipment excellent facilities for this work.

Eugene Munsell & Co. of New York and Chicago, importers and dealers in amber mica, report a gratifying demand for all their insulating specialties. The India mica is being used very largely by electrical manufacturers and street-railway companies, both in this country and in Europe, on account of its being free from iron as well as its high insulating qualities.

The Ward Leonard Electric company's new catalogue of iron outlet boxes is comprehensive and valuable. The arrangement is good, and the illustrations are clear and helpful. The company, which installed over 80,000 boxes in New York city last year, is addressed at Bronxville, N. Y. The western representatives are Meysenburg & Badt, 1504 Monadnock block, Chicago.

The Boston Gas Light company is erecting a new gas-plant at Commercial Point, in the vicinity of Boston. This new plant consists of a building about 52 feet wide and 185 feet long, having brick side walls and brick partition walls. The floors are of steel throughout. The roof is covered with slate supported on steel roof trusses and framing. The contract for furnishing and erecting the steel roof work complete has been let to the Berlin Iron Bridge company of East Berlin, Conn.

In addition to Crescent telephones, the Pennsylvania Electric company of Marietta, Pa., manufactures what it claims to be "a thoroughly reliable automatic electric temperature regulator." This regulator embraces a thermostadt in conjunction with an electric automatic valve controller for radiators and an electric automatic damper controller for drafts and dampers which can be furnished, it is said, at a much lower cost than any apparatus now on the

market used for a similar purpose. Correspondence is solicited.

The Lynn Incandescent Lamp company of 685 Washington street, Lynn, Mass., makes a specialty of renewing burned-out lamps. It also buys old lamps outright. "Our renewed lamps," the company says, "are just as long-lived and generally satisfactory as new ones. We replace the filament with a new one in exactly the same manner as in making a new lamp. We clean the bulb and use the same care as regards uniformity of voltage, candle power and current consumption as in making our new lamps." A "renewal circular" is sent to those desiring information.

The Standard Light and Power company of Dallas, Texas, has placed an order with the Walker company for two alternators, one of 225 and the other of 325 kilowatt capacity. They are to be direct-connected to Erie engines and are designed to run at 125 revolutions per minute. The current will be two-phase and 60 cycles. In addition to these the Walker company will furnish two direct-connected railway generators of 225 and 325 kilowatt capacity respectively. Two alternating generators of 250 kilowatt capacity each are being built for the North River Electric Light and Power company of New York city. They are to be of the belted type. Townsend, Reed & Co. of St. Louis have purchased for the St. Louis, Belleville and Suburban Electric Railway company two 200-kilowatt direct-connected Walker railway generators, besides eight double to "S" railway equipments with "S" controllers. On the other side of the Atlantic the Glasgow municipal tramway will place a number of Walker motors on its cars at an early date, while the electric railway of Alexandria, Egypt, will increase its present Walker plant by the addition of one 150-kilowatt belted generator with switchboard and four double three "N" equipments.

The extensive application of chloride accumulators manufactured by the Electric Storage Battery company is indicated by the large business of the company. The latest contracts cover batteries to be used in connection with electric elevators in the 30-story office building being erected on Park Row, New York, where 58 chloride accumulators of 1,500 ampere-hour capacity will be installed; for the Cushman building, New York, 118 320 ampere-hour cells; the Dun building, New York, 114 1,100 ampere-hour cells. The State Mutual Life Insurance company, of Worcester, Mass., has contracted for an increase in its original plant. Very large plants are being constructed for the Chicago Edison company and the Buffalo Railway company. Chloride accumulators are being installed in the residences of Mr. John I. Waterbury, Morristown, N. J., and Mr. G. P. Morosini, Riverdale, New York; also in Mr. Howard Gould's new steam yacht Niagara and Mr. Lloyd Phœnix's yacht Intrepid. The American Fire Insurance company's building in Philadelphia is being equipped with a battery for night lighting. The Germantown, Pa., Hospital, which has operated a battery of chloride accumulators for about two years, is increasing the capacity of its plant by 50 per cent. Cells, ranging in capacity from 400 ampere-hours to 1,200 ampere-hours, have been furnished to the Cleveland Telephone company and the Southern Bell Telephone company; 1,300 cells have also been supplied for fire-alarm work at Portland, Ore., Augusta, Ga., and St. Paul, Minn. For telegraph work the Lehigh Valley Railroad company has ordered 208 cells, the Southern Pipe Line company 50 cells, the Great Northwestern Telegraph company 265 cells, the Chicago, Milwaukee and St. Paul Railway company 276 cells, and the Postal Telegraph-cable company 220 cells. The General Electric company has contracted for 112 cells of from 160 to 200 ampere-hours' capacity; the Patton Motor company and the National Electric Car Lighting company are installing 432 cells in connection with their systems, and the State School of Mines, Colorado, has equipped its laboratory with 52 cells of 160 ampere-hours' capacity.

ILLUSTRATED ELECTRICAL PATENT RECORD.

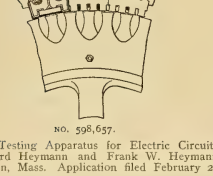
Issued February 8, 1898.

598,498. Junction Box for Electric Conductors. Thomas J. Close, Philadelphia, Pa. Application filed May 26, 1897.

This device consists of a body portion having openings in its sides and provided with a flanged rim having openings therein, a lid with a bail and provided with openings registering with the flange openings and a gasket between the flange and lid, the lid and flange having an interlocking ridge and groove joint.

598,508. Automatic Electric Fire Alarm. William A. Guthrie, Durham, N. C. Application filed July 7, 1897.

Claim is made for a combination push-button and automatic electric fire-alarm comprising the base adapted to be secured to the ceiling or other overhead support, a pair of plates and binding-screws on the under face thereof, one of the plates having a downwardly-curved extension normally in contact with the other, a push-button of easily fusible metal below the curved extension, and a wire passed through openings in the curved extension and the button and having bent ends, whereby the button is suspended from the curved extension and holds it out of contact with the other plate.



NO. 598,657.

598,517. Testing Apparatus for Electric Circuits. Edward Heymann and Frank W. Heymann, Boston, Mass. Application filed February 26, 1897.

This instrument comprises a plurality of line terminals, to which the circuits to be tested are connected, an auxiliary circuit provided with terminals co-operating with the line terminals, movable circuit-controllers co-operating with the line terminals and with the terminals of the auxiliary circuit, means to impart to the circuit-controllers different rates of movement, and an electro-magnet in the auxiliary circuit governing the operation of the means.

598,540. Construction of Dynamo-electric Machinery. Alfred Soames, London, England. Application filed December 6, 1897.

A dynamo-electric machine in which an assemblage of sheet-metal rings and the bearings for the armature shaft are secured to the frame concentrically one with the other by type metal or other suitable material cast between them and the frame.

598,553 Electric Switch. Johan M. Andersen, Boston, Mass. Application filed December 5, 1896.

This device includes a stationary member composed of a base piece and side arms integral therewith and extended at an angle thereto, a movable member composed of a back piece and side arms integral therewith and extended at an angle thereto and adapted to make a sliding contact with the arms of the stationary member, an actuating lever for the movable member pivoted with a socket, and a spring located in the socket and acting on the movable member.

598,556. Primary Battery Cell. Fred H. Brown, Chicago, Ill. Application filed December 9, 1895. Renewed January 12, 1898.

The negative element is composed of an agglomerate of black oxide of manganese and plumbago, having a superimposed layer of carbon and a sealing cap of insulating material, and a conductor arranged therein and chloride of silver introduced in the agglomerate adjacent to the conductor, and a positive element arranged adjacent to the conductor.

598,568. Method of Manufacturing Rheostats. Electric Heaters. Harry W. Leonard, New York, N. Y. Application filed April 9, 1897. Divided and this application filed January 3, 1898.

The method of arranging the resistance of a rheostat into steps consists in making the ohms of each step practically proportionate inversely to the square of the current through the step when it is subjected to its maximum duty, so that the current squared times the resistance under maximum conditions will be practically constant per square inch for each step.

598,580. Trolley Head. Herbert W. Smith, Somerville, Mass. Application filed June 10, 1897.

The claim is given: The combination with a trolley head having a handle enlargement, a groove in said enlargement, of an endless ring closed into said groove so as to inclose the coil-box, a part of the circumference thereof, the remainder of said ring being bent outward to form an eye for the attachment of a trolley rope.

598,610. Coin-controlled Telephone Pay Station. William Gray, Hartford, Conn. Application filed December 4, 1895.

One feature is a coil-box having a metallic base, a transmitter mounted on the coil-box, a toll-box secured to the metallic base of the coil-box, a toll-coin-controlled device located within the box and mounted on the wall thereof.

598,638. Electric Heater. James F. McElroy, Albany, N. Y. Application filed March 24, 1894.

This heater consists of end pieces, each provided with a chair, a tube fastened in the end pieces, supply and return conductors arranged within the tubes, plates adapted to rest in the chairs, a spindle connected with the plates, a coiled resistance on the spindle, the resistance-carrying spindle placed intermediate of the tubes, and a series of rods passing from one end piece to the other.

598,640. Electric Heater. James F. McElroy, Albany, N. Y. Application filed April 6, 1895. Divided and this application filed August 6, 1897.

Two overlapping plates are adapted to slide relative to each other, and are provided with insulating edges; means are also provided for connecting the plates together, and springs are arranged between the plates tending to force them apart, while a resistance wire is wound around the plates.

598,655. Coin-controlled Machine for Automatically Distributing Electric Currents. John W. Dawson, Louisville, Ky. Application filed November 18, 1895.

The mechanism described comprises movable electrodes and a pair of batteries, a battery-changing device connected to and operated by the electrode, whereby the batteries are alternately thrown into and out of circuit.

598,657. Alternating-current Dynamo. William B. Esson, London, England. Application filed April 21, 1896. Patented in England March 25, 1895.

An armature composed of detachable core-sections, each provided with slot-tunnels or passages, and a coil extending through the tunnels and embedded in the core-section is the principal feature.

598,679. Means for Use in Operating Electrical Switches. Thomas H. Parker, Tettenhall, England. Application filed December 9, 1897.

In apparatus for use in operating successively two or more electrical switches or sets of switches there is the combination of two or more rollers or disks having notches or gaps therein and studs which project therefrom, means for rotating such disks, intermediate levers or arms, each mounted upon a fixed pivot axis and having a bifurcated end for engagement with a stud which is carried by a disk, and a shoulder which is at somewhat greater distance from the pivot axis of the lever than the distance from such axis to the nearest point of each corresponding roller or disk, and means by which each lever operates a switch or set of switches as it is moved by its corresponding disk.

598,697. Electric Arc Lamp. Sidney I. Crain, Cincinnati, O. Application filed July 24, 1897.

A pair of pivoted arms carries rollers adapted to engage with the carbon-rods at or near the point of support, and electrical connection is made between the rollers and the main.

598,715. Automatic Electric Switch. Frank C. Perkins and John D. Killip, Buffalo, N. Y. Application filed September 25, 1897.

In an automatic electric switch, the combination with a base having a contact, of a switch-lever arranged to swing at right angles to the base and provided on its inner side with a catch extending toward the base, a locking-lever pivoted to swing parallel with the base interlocking normally with the catch and provided with a pointer, a scale mounted on the base and traversed by the pointer, an expansible thermal rod or wire included in the circuit and controlling the locking-lever, and automatic means for opening the switch-lever when released.

598,726. Incandescent Electric Lamp and Process of Making Same. John C. Fish, Shelby, O. Application filed August 3, 1897.

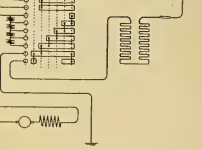
The following steps in the manufacture of an incandescent electric lamp are described: Taking a tube having a flange on its end, fusing to the side of the flange which is opposite the tube a mount, the flange being substantially flat or in the form of a disk, whereby the fusing flange may conveniently be brought against the side thereof opposite the tube, and fusing the flange to the base of the lamp globe.

598,731. Electric Railway. Martin T. A. Kubierschky, Berlin, Germany. Application filed March 26, 1897. Patented in Germany January 1, 1896; in Belgium November 28, 1896; in France November 28, 1896.

One claim is for the combination of a motor for propelling the car, electric heaters, a controller cylinder provided with contacts for regulating the energy supplied to the motor, contacts on the cylinder for including a heater in circuit at the time the motor circuit is interrupted, contacts for re-establishing the heater circuit when the controller cylinder has been moved to a high-speed position, and a cut-out switch for the heater.

598,733. Safety Cut-out for Electric Lamps. Alfred N. Lovelace, Knoxville, Tenn. Application filed June 12, 1897.

A fuse-box is provided at opposite side edges with inturned retaining flanges and with a central longitudinal partition strip, a pair of aligned contact springs arranged at each side of the partition strip and having curved free ends normally projected beyond the edge thereof, a removable lid slidably engaging beneath the flanges, and separate pairs of aligned contact plates fitted to the inner side of the lid and connected by short fuse wires, the contact plates being engaged by the curved free ends of the springs which exert a pressure thereagainst.



NO. 598,731.

598,853. Electric Call-box System. William T. Budds, Charleston, S. C. Application filed August 23, 1897.

A call-box system is described, comprising a main wire, call-boxes having a shunt connection with the main wire, and also having a ground connection, a battery with one pole of which one end of the main wire connects, a wire leading from the other pole of the battery, a switch for connecting the last-named wire with a ground wire, a switch for connecting the last-named wire with the main wire, the first-named switch also operating to connect the ground wire with an intermediate element of the battery, and a sounding device in each extremity of the main wire.

598,894. Electric Time Switch. George F. Goodwyn, Arthur, Canada. Application filed April 26, 1897.

The claim is made in an electrical time-switch for the combination with a base, contact plates secured to the base, and a switch-lever pivoted to and insulated from the base, of a clock, a bracket secured to the clock, a screw through the bracket to support and adjust the switch-base, means for guiding the switch-base during its adjustment, and means connected with the works of the clock to press the switch-lever against the contact plates and to release the same at predetermined times.

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Independent Telephone Movement.

The development of the independent telephone movement has been one of the surprises of the century, even to those who have been its most ardent advocates. It can be said that the commercial world has rarely if ever witnessed a similar expansion of an industry in such a short time as that which marked the introduction of the telephone since the field was opened to independent companies by the expiration of the fundamental Bell patents. And yet all indications point to an even greater development. This is only the beginning. The people of the country are just awakening to a realization of the fact, it would seem, that what was for many years a luxury within the means of comparatively few is to-day not only a possibility but a necessity. Hence the popularity of the independent movement with the mass of the people.

It will be appreciated that such a project could be successfully conducted only by the active, persistent and united efforts of an intelligent and enthusiastic body of men. These requisites, it will be admitted, are possessed in a high degree by the leaders of the independent telephone movement. They have succeeded in creating a new industry, for that is really what the present movement amounts to, developing suitable apparatus and establishing high standards of construction, equipment and operation that compare favorably with Bell methods. Some facts about the men who have been instrumental in bringing this about will prove interesting at this time.

JAMES F. KEELYN

One of the most prominent figures in the independent telephone movement since its inception has been James F. Keelyn, president of the Western Telephone Construction company of Chicago. Mr Keelyn is a native of Albany, N. Y., and is still a young man. For 20 years he has lived in the West, and much of that time in Chicago. He is familiar with the Bell policy and methods through long service with that company. Mr. Keelyn entered the Wisconsin Telephone company's service when it was formed and was manager of the Racine exchange from 1880 to 1882. Anticipating the expiration of valuable patents held by the Bell people, he began preparations for work for the telephone business and in 1886 formed the Western Telephone Construction company of Chicago. He has since been closely identified with the independent telephone business and is one of the most aggressive factors in the movement.

W. A. BISLAND

Another pioneer in the independent movement is W. A. Bisland, the vice-president of the Western Telephone Construction company. Mr. Bisland joined the movement a few months after the formation of the Western Telephone Construction company, and he has been identified with it ever since. He is an experienced business man and he had been identified with the technical department. His career before entering the telephone field was largely in New York. He was for 15 years on Wall street and in that time came to know the value of an enterprise, he says. His decision to take up the telephone business as an anti-Bell man was reached after careful consideration, and has, he believes, proved the wisest conclusion he has ever reached.

H. C. DODGE.

Harry C. Dodge, the general manager of the American Electric Telephone company of Chicago, has been identified with the development of telephone and electric-lighting enterprises, power transmission and general electrical construction work since 1883. A considerable portion of that period was spent in the telephone field, especially in the management of exchanges and toll-line systems controlled by the Wisconsin and Central Union Telephone companies. Mr. Dodge's early experience in the independent movement was acquired as promoter and organizer of sub-companies for the Western Telephone Construction company. He was one of the organizers and incorporators and the general manager of the Northwestern Telephone and Electric company, and he was the original promoter and one of the incorporators of the Standard Telephone and Electric company of Madison, acting as chief electrician and general superintendent of the latter company from the date of its incorporation until he resigned one year ago to become associated with F. C. Burns of the American Electric Telephone company as general manager. In his new capacity Mr. Dodge has added to his list of friends and has increased his reputation for executive ability.

1. W. A. Bisland. 2. James L. Keelyn
3. Paul W. Jessup. 4. A. Stromberg
5. A. Carlson. 6. H. C. Dodge.

INDEPENDENT TELEPHONE MOVEMENT.

MESSRS. STROMBERG AND CARLSON

Any history of the telephone business, independent or Bell, would be incomplete without mention of the part taken in the development of the industry by Messrs. Stromberg and Carlson of Chicago, whose work is particularly appreciated throughout the West.

A. Stromberg was born in 1861, just outside of the city of Stockholm, of a family of mechanics. His boyhood days were spent in the shops of his father, who was a manufacturer of grain threshers, but he was not content with that line and, at the age of 15, went to Stockholm and started in the mechanical department of Eller & Co., the oldest electrical company of that country. Late in the seventies he worked with a construction company, putting up telegraph lines between the larger cities. The year following he put up some of the first magneto telephones that were used in that country. Early in 1879, when the company received the first pair of battery transmitters introduced there, he assisted in the test. Mr. Stromberg engaged with the Bell company when it put in an exchange at Stockholm and others throughout the Northern Peninsula and Denmark. Towards the latter part of 1883 he came to this country. His first experience in the United States was gained in Pennsylvania, where he was engaged in building exchanges for the Bell company. He started with the Chicago Telephone company in 1888. He remained in the instrument department about two years, during which time he invented many new devices, some of which are still being used by the Bell company. He next took up outside construction and then the burglar-alarm department as electrician. In 1890, when the Chicago Electric Protection company was organized to compete for the burglar protection business in Chicago, it placed Mr. Stromberg at the head of the electrical department. The company's principal patents were on his inventions.

A. Carlson was born in the autumn of 1854, in the southern part of Sweden, not far from the town of Borsa. He developed a taste for mechanical work early, and was continually making new devices for play or usefulness, preferring work that called for the exercise of his judgment, skill and ingenuity at every step of its progress. He came to this country early in the 70's, and after spending some time in different parts of the country eventually settled in Chicago. For several years he was engaged in electrical, mechanical and construction work, and finally entered the telephone field with the Chicago Telephone company in the mechanical department. He remained with the company until the independent field was opened.

Messrs. Stromberg and Carlson experimented on magneto transmitters, and by the time the fundamental Bell patents expired had their magneto telephone completed and fully covered by patents. Early in January, 1894, they resigned their respective positions, to take effect on the first of that month, the day the independent telephone business was opened, and they concluded arrangements for the manufacture of their apparatus with the Western Telephone Construction company. This magneto apparatus is well known and many of the instruments are in successful operation to-day. When the battery-transmitter business was opening, they determined to engage in that branch, and on May 10, 1895, the corporation bearing their name was organized. Both Messrs. Stromberg and Carlson, while not born in this country, renounced all foreign allegi-

ance and became thoroughly Americanized citizens as early as the laws permitted.

Besides equipments for public-exchange work and private intercommunicating plants, they have perfected police and fire-alarm and street-railway systems. They claim that the next few years will unveil wonders in practical telephony.

J. J. Nate.

Among telephone men of experience it seems unnecessary to speak of the record of J. J. Nate, the general manager of the Standard Telephone and Electric company of Madison, Wis. Mr. Nate entered the service of the Bell Telephone company at Chicago with the introduction of the first telephones in the West, in June, 1878, and remained with that company until January 1, 1894. During his connection with the Bell company he gained a thorough knowledge of the business through his appointment from time to time to positions of responsibility and trust in various departments—as operator, foreman, superintendent of equipment, operation and supplies, and more recently as purchasing agent, having filled the latter position for over 10 years. Improvements in the apparatus manufactured for the Chicago Telephone company were largely due to the efforts of Mr. Nate and his associates, who, as practical experts, co-operating with the Western Electric company, suggested, tested and approved much of the apparatus in use by the Bell company to-day. As early as 1879, Mr. Nate became interested in the development of switchboards and telephone apparatus, having successfully superintended the installation of the switchboards used in Chicago, and made necessary in the earlier years by the rapid growth of the business and inefficiency of the apparatus then manufactured. It is needless to say that this experience has proven of value to the company with which he is now connected.

Paul W. Bossart.

Paul W. Bossart is entitled to the distinction of being one of the prominent pioneers in the telephone business. As early as 1879, in company with General O. E. Madden, whose title then was superintendent of agencies of the National Bell Telephone company, he organized a telephone exchange company in Kansas City, Mo. Mr. Bossart was appointed superintendent. This was the second Bell exchange to start in the West, Cincinnati being first, St. Louis and Omaha following soon after. St. Joseph, Joplin, Carthage, Springfield, Mo., were added to the list, and the entire state of Kansas soon had exchanges in all its principal cities. These were constructed under the personal supervision of Mr. Bossart, and remained under his management for a number of years. It may be mentioned incidentally that his career as an expert telegrapher tended in a great measure to fit him for the work. After filling the position of general superintendent of the United Telephone company, which was made up by the consolidation of all the exchanges in Kansas and southwestern Missouri, he was transferred to the New England Telephone company as superintendent, a place he resigned for a position in Edison's laboratory, where he assisted in developing the phonoplex system of telegraphy. Mr. Bossart re-entered the telephone field in 1894 and has been prominently identified with the independent telephone movement constantly since that time. His familiarity with every detail of the business fits him in a high degree for the responsible position of manager of the Pennsylvania Electric company.

Messrs. Doolittle and Cook.

A recent acquisition to the independent telephone forces of considerable importance is the Sterling Electric company of Chicago.

W. E. Doolittle is the general manager of the company. He was born at Lafayette, Ind., and at an early age began to shift for himself. First as a messenger boy for the Western Union Telegraph company then an operator at the age of 15, and after service of seven years with the Western Union company, becoming manager for the Baltimore and Ohio Telegraph company. Upon the consolidation of the Baltimore and Ohio with the Western Union Mr. Doolittle entered the service of the Postal Telegraph company and the Central Union Telephone company at the same point as manager. Upon the advent of the independent telephone movement Mr. Doolittle was one of the first to encourage it, as he recognized in it the opening of a broader field for operations. Mr. Doolittle severed his connections with the old concerns to accept the general management of the Lafayette Harrison Telephone company, which he developed from an experimental system to one of the largest and most successful independent exchanges in the field. On February 1st he came to Chicago to assume the management of the Sterling Electric company.

F. B. Cook, chief engineer of the Sterling Electric company, was born in Monroe, Mich., removing to Toledo, Ohio, while young. Early in life Mr. Cook developed an aptitude for mechanical and electrical work, entering the [illegible] of the first Bell Telephone company [illegible] and having charge of the construction of the system. He has worked in several Bell sub-companies for 10 years. Soon the mechanical and electrical genius developed in Mr. Cook was recognized by the Bell company and it pushed him rapidly forward to the office of chief engineer of the Central Union property. This position he held for 11 years prior to 1897. While in the Bell company's service Mr. Cook invented and patented devices perfecting and improving the central-office equipment and instruments of that company. He retained an interest in the greater part of these patents. In 1896 Mr. Cook severed his connection with the Central Union company, as he recognized that the independent telephone field offered larger and more promising opportunity.

Charles W. Farr.

Few men are better and more favorably known in the telephone business than Charles W. Farr, president of the Farr Telephone and Construction Supply company of Chicago, whose portrait is presented herewith. Mr. Farr was born in Port Huron, Mich., in 1849, and early in life took a fancy to telegraphy and telephony. At the age of 22 he became connected with the Western Union Telegraph company, serving for 14 years under District Superintendent E. P. Wright, with headquarters at Cleveland, O. It might be mentioned that for the entire 14 years Mr. Farr did not miss a single day. He was the local manager of the company for 14 years. The three years following he served under I. McMichael, district superintendent of Minneapolis, Minn. He then became local manager of the Michigan Bell Telephone company, with headquarters at Detroit, which position he filled for eight years. During his last year with the Bell company, he served mostly as state inspector, examining most of the exchanges and making himself thoroughly familiar with every phase of telephony. He then came to Chicago, and in February, 1895, formed the Farr Telephone and Construction Supply company. The company is at the present time the only wholesale telephone supply house in the West. The principles which Mr. Farr and his associates have always followed have given the firm an honorable name, and as a consequence the company has and is receiving orders from all over the world. The Farr company manufactures everything in the telephone line—from the smallest part to complete exchanges—and the excellence of its products has given it an enviable reputation. Mr. Farr is an unassuming quiet gentleman and is highly esteemed by all who know him. His untiring efforts have placed the Farr company where it is to-day, and the concern is to be congratulated on having so energetic a man at its head.

Messrs. McFell and McWade.

The McFell Electric company of Chicago was incorporated in 1890. The members of the company are Judson McFell, president and treasurer, and William J. McWade, secretary and general manager. Both were born in Port Dover, Ont. Mr. McFell came to Chicago and entered the service of the Western Electric company in 1881, and it was under his supervision that the first intercommunicating system of telephones was installed in Chicago. He has since installed a number of systems in this and other cities. Mr. McWade resigned a good position with Pullman's Palace Car company in order to become a member of the firm, and has ever since been an active member of the concern. The company has made a record in the last few years which it may justly feel proud of. It has had some of the largest and most complicated contracts in the city, and it now handles a full line of telephone goods. The company's microphone is considered by experts to be a high-class instrument.

2. W. J. McWade. 3. Judson McFell. 1. Frank B. Cook. 4. Charles W. Farr. 5. W. E. Doolittle.

INDEPENDENT TELEPHONE MOVEMENT.

James S. Cuming.

The Central Telephone and Electric company of St. Louis is a copartnership between James S. Cuming and R. T. Durrett, and succeeded the D. A. Kusel Manufacturing company on October 14th.

James S. Cuming, the general manager of the Central Telephone and Electric company, was born in St. Louis, and after passing through the public schools of the city entered the wholesale grocery business as an office boy for the Krafft Holmes Grocer company. At the age of 19 he was offered a position to represent the James M. Houston Grocer company in the territory embracing all towns between St. Louis and Fayetteville, Arkansas, on the Frisco railroad. Mr. Cuming at once met with success as a commercial traveler and continued as such for about four years, in which time he covered the greatest part of the state of Missouri. On June 22, 1895, Mr. Cuming purchased a half interest in the business of the D. A. Kusel Telephone Manufacturing company, and though the profits for his first five months in the telephone business were less than expenses, Mr. Cuming's energy and straightforward, businesslike methods soon won recognition, and by the end of the first year the company was compelled to seek larger quarters in order to take care of the increased demands of its customers, and again

in September, 1897, the company found that it would be necessary to increase its capacity, and moved to the present quarters at 1123 Pine street. The company had by this time built a business which was quite valuable, and Mr. Cuming had no difficulty in finding additional capital for the business. Mr. Durrett confines his entire attention to the financial part of the business, and Mr. Cuming has full control of the firm's business policy. Mr. Cuming has always kept fully posted on the telephone situation and has recently made some very important improvements both in telephones and switchboards, bringing the instruments strictly up to date in every particular. A full description of the switchboard was given in the Western Electrician of January 4th.

On the afternoon of January 7, 1898, a proposition was made to Messrs. Cuming and Durrett to purchase the entire stock and good will of the Missouri Telephone Manufacturing company, a corporation which was established several years previously and which had succeeded in establishing considerable demand for its goods. This addition

1. S. H. Couch. 2. R. L. Whitman.
3. Henry J. Swarts. 4. J. W. Thomson, Jr.
5. James S. Cuming. 6. James E. Randall.

INDEPENDENT TELEPHONE MOVEMENT.

in the stock and business of the Central Telephone and Electric company has kept the firm exceedingly busy. Mr. Cuming's policy has been to give full value for every cent paid, to never let any customer have a just cause for complaint, to hold up to the highest standard of quality on instruments, and never allow quality to be sacrificed to price. The company has maintained an excellent reputation for financial responsibility.

Stanley S. Stout.

While the development of the independent movement was made possible by the expiration of the fundamental Bell patents, there were several serious obstacles to be overcome, not the least of which were the switch patents, known as the Watson and Roosevelt patents. These were subjects of litigation, and it is said that the decisions recorded against the Bell interests in these cases were the only complete defeats sustained in patent litigation by that powerful corporation. Stanley S. Stout conducted the litigation for the Western Telephone Construction company in these actions. Mr. Stout was for several years a Patent Office examiner before practicing law. He has, however, had wide experience since in electrical patent litigation.

J. W. Thompson, Jr.

The head of the J. W. Thomson, Jr., & Co. Manufacturing company of Bedford Indiana, is only 28 years old. He was born in Clark County, Ind., and received his primary education in the public school at Jeffersonville, and afterward took a course in electrical engineering at the Purdue University. After leaving college he was engaged for about a year in contracting, principally in installations of electric-light plants. He then turned his whole attention to telephony, in which pursuit he has achieved success.

James D. Randall.

A representative of the southern telephone interest is presented in Captain James D. Randall of Memphis, Tenn., who entered the field of independent telephony in 1884 with the Pan-electric Telephone company. With 12 other citizens of Memphis he purchased the rights for Tennessee at that time. After organizing the state company it was deemed advisable to commence operations in Memphis, and a local company was chartered under the name of the Memphis Pan-electric Telephone company, and Mr. Randall was elected secretary, treasurer and manager of this company. After about 100 telephones were put in and connected to switchboards, the American Bell Telephone company obtained injunctions in Texas and Missouri against companies using the Pan-electric telephones, after which the directors of the Memphis company decided that it was only a question of time when they would be compelled to close, so the work was discontinued and the business wound up. Captain Randall, believing there would soon come a time when telephones could be sold and operated outside of the Bell circle, made a study of this very valuable instrument and has worked faithfully in this line ever since. He has superintended the construction of exchanges in Tallahassee, Fla., Jonesboro, Ark., Greenwood, Corinth and Holly Springs, Miss., and sold telephones and switchboards in several towns and for private lines in the South. He has also made several very valuable improvements in telephones, most of which have gone to the public.

Henry J. Swarts.

Among the inventors and manufacturers who have attracted attention in the independent movement in the South, Henry J. Swarts, the inventor of a novel form of switchboard, occupies a conspicuous position. Mr. Swarts has made Knoxville, Tenn., his headquarters and he has formed the Swarts Switchboard and Electric company, to manufacture under his patents. Mr. Swarts is a native of Port Byron, N. Y. He entered into the telephone field in 1883, his first experience being at St. Joseph, Mich. He was later appointed district inspector, with headquarters at Kalamazoo, and remained with this company six years, the last two years finding him in charge of the sub-exchange in Detroit. He resigned this position to accept one with the Chicago Telephone company, where he had about a year's experience. His next change was made when he received the appointment of electrician with the East Tennessee Telephone company at Chattanooga, Tenn. He joined the ranks of the Southern Bell Telephone company at Atlanta, Ga., and remained in Atlanta five years. His experience with the Bell interests has proved valuable, as he is thoroughly familiar with their apparatus. The switchboard which he is now manufacturing is said to have been entirely his own invention, even to the smallest detail.

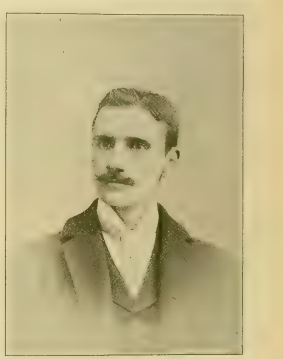
Messrs. Whitman and Couch.

The firm of Whitman & Couch, telephone manufacturers, started in 1895 with a small office and shop in which only three men were employed. Gradually the business increased till they required a complete factory to make all parts and assemble the work. This they established at 196 Summer street, Boston, Mass. Portraits of the members of the firm are presented herewith.

R. L. Whitman handles the finance of the concern and attends to the home office. He has been in the telephone business since his graduation from Harvard College in 1895.

S. H. Couch is the practical man of the firm, having been engaged in electrical work for the last 12 years. Mr. Couch makes a trip every year visiting exchanges throughout the country.

An example of the work of this concern is furnished in the case of the People's Telephone company of Haverhill, which was incorporated under the laws of Massachusetts with a capital stock of $1,000, and in 1895 built a few lines for private individuals and a few corporations, banks, etc. In 1896 the capital stock was increased to $11,000 and a general exchange was started with 150 subscribers. In 1897 the building was continued and subscribers added, until in 1898 the company was reorganized with Charles Spofford as president, Ira Sawyer secretary, and Raymond L. Whitman treasurer and managing director. At this time the number of subscribers had increased to 450 and the capital stock was increased to $100,000. This exchange is peculiar in that it is the only company in the telephone-exchange business incorporated under the laws of Massachusetts. The central station is different from any other central station in existence to-day, since the switchboard consists of a table 32 inches square with the jacks set in the top in a horizontal position to accommodate one thousand lines. Sections of 20 jacks may be added at any time. The drops are placed upon the walls of the room, so that with four girls, one sitting at each edge of the table, each girl faces 250 drops, and owing to the small space of the jacks, without doing any turning, each girl can reach any one of the one thousand jacks, thus reducing the number of operators to a minimum and making the service very rapid. All the lines of this exchange are metallic circuit and the Whitman & Couch telephones are used throughout. This company intends to push its lines throughout the eastern part of Massachusetts in the early spring and is anxious to connect with any exchanges in its vicinity.



S. W. MOON.

S. W. Moon, President of the Laclede Battery Company.

It was in March, 1894, that President S. W. Moon of the Laclede Battery company of Kokomo made his start in the electrical business. At that time Mr. Moon purchased from P. C. Burns the battery department of the Laclede Carbon and Electric company of Kokomo, and it was then that Mr.

Moon was appointed manager also of the American Electric Telephone company, also of Kokomo. The battery department, however, extended so rapidly that it became a business in itself and was run under Mr. Moon's management as the Laclede Battery company.

movement, and his experience with the two companies has eminently fitted him for his present responsible position. The American Electric Telephone company during the last few years has developed to such a remarkable extent and is said to be doing such a fine business that the position

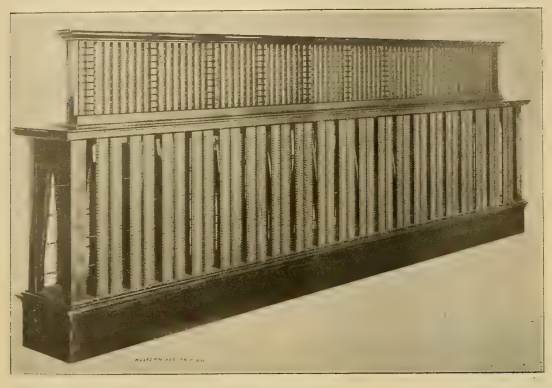


FIG. 3. FORT WAYNE TELEPHONE EXCHANGE.

In the spring of 1897, when the factory of the American Electric Telephone company was removed from Kokomo to Chicago, Mr. Moon transferred his headquarters to the office of the American company and took there the position of auditor and assistant manager of the latter company, but he still retained a proprietary interest in the Laclede Battery company, of which he is still president.

From this it will be seen that Mr. Moon has been identified with an independent telephone manufacturing company and a kindred interest practically from the start of the independent movement, and his experience with the two companies has eminently fitted him for his present responsible position. The American Electric Telephone company during the last few years has developed to such a remarkable extent and is said to be doing such a fine business that the position of auditor alone is one that practically occupies Mr. Moon's entire time.

Fort Wayne Telephone Exchange.

In the system of the Home Telephone and Telegraph company of Fort Wayne, Ind., all the wires in the central district of the city are underground and are encased in vitrified tiles laid in an envelope of concrete. The manholes are large and commodious, and afford every facility for drawing in new cables and testing for faults. The cables are of fiber insulation, made up in twisted pairs and encased in lead. All overhead wire is of hard-drawn copper, and metallic circuits are used throughout. The complete telephone equipment of this exchange was furnished by the Western Telephone Construction company. The switchboard, of 1,600 drops capacity, is shown in Fig 1, and is of the multiple-transfer type. The drops are restored automatically by the insertion of the plug into the jack. All of the switchboard cords are encased in spiral wrappings of hard brass wire, with an extra braiding of heavy polished linen ,reinforced in the heel of the plug as an extra precaution against breakage. The chief operator's set is shown at the left in the cut, and by its use the chief may cut in

FIG. 2. FORT WAYNE TELEPHONE EXCHANGE.

on a conversation of any operator to see whether she is attending strictly to business. The chief may also, have her telephone switched into connections with any subscriber in order to receive complaints or to give instructions to men who are out upon the lines. The distributing board is for 2,000 metallic circuits and is placed behind the main switchboard. The top can just be seen above the top rail of the switchboard proper. In Fig. 2 is shown the South Side branch exchange of this company, where 300 lines terminate, and through which connection is afforded with the main exchange by metallic-circuit trunk lines which run through direct. This branch exchange was established a few months ago in order to meet the rapid growth of the system, and it is probable, within the next few months, either it or the main board will have to be enlarged or else another branch exchange established in another part of the city.

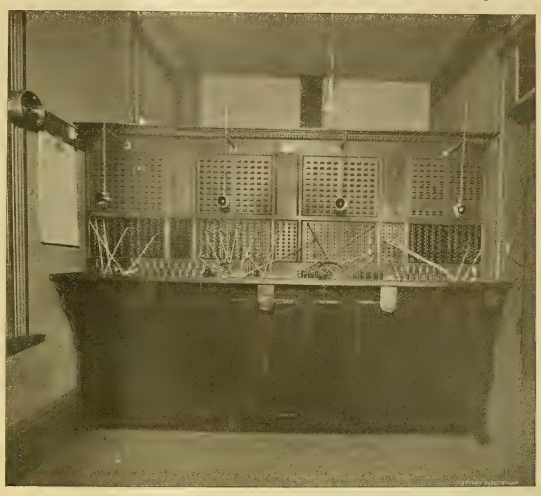
FIG 1. FORT WAYNE TELEPHONE EXCHANGE.

Fig. 3 shows the distributing board recently designed and constructed for large exchange work. This board is of the type recently installed as a complete lightning-arrester board, distributing board and test board in itself. The side of the board shown in the cut is that on which the lightning arresters are placed. Ample space is afforded beneath the board for cableways, and each cable is led up and fanned out to the terminals of lightning arresters. Jumper wires then run back from the lightning-arrester terminals around the horizontal rods shown on the interior of the boards and then up into the rack on top of the entire structure. This rack is provided with ways along which the wires run horizontally, a separate way being provided between the pins for each 100-section of wires. When the wire has reached the point opposite which it is desired to make a connection on the test side of the board, it is turned vertically downward over one of the pins shown and passes to the other side of the board and is connected to the proper test terminals. These test terminals form permanent terminals for the cable leading from the switchboard. A wire can be disconnected from its present number on the switchboard and transferred to any other number desired without confusion and in a few minutes. All of the transfer or jumper wires lie parallel with each other, and the arrangement is so open and systematic that any wire can be located in a moment. By means of a special plug which can be inserted in any one of the test clips it is possible to test out on any line in either direction of the subscriber or of the switchboard itself. This greatly facilitates the localization of trouble.

The history of this enterprise is an interesting one and affords a striking example of what good business management coupled with good engineering work will do in the face of almost every adversity. The plant began operation on October 1, 1896, with 856 telephones connected. At that time the switchboard capacity was 1,000. In December, 1896, the business had grown so that the installation of an additional switchboard section having a capacity of 300 drops was demanded, and in April of 1897 still another addition of the same size was made and the branch office was also established on the South Side of the city. It is a significant fact that the Bell company has not now as many subscribers in the entire city as are at present connected to the South Side branch of the Home Telephone company's exchange. Less than two years ago the Bell company had 528 subscribers, and now, although it has given free service to a great many patrons, the total number of stations is less than half that number.

The plant of the Home Telephone company cost $190,000. A two per cent. dividend was paid at the end of the first quarter after the exchange was put into operation, and a like dividend has been paid at the end of every succeeding quarter.

The original incorporators of the company were George W. Beers, Charles S. Bash, Louis Fox, W. J. Vezey and Charles M. McCulloch. These gentlemen represent the largest financial and industrial interests in the northern part of Indiana. The officers of the company from the beginning have been as follows: President, George W. Beers; vice-president, S. M. Foster; secretary, L. Fox; treasurer, Charles M. McCulloch.



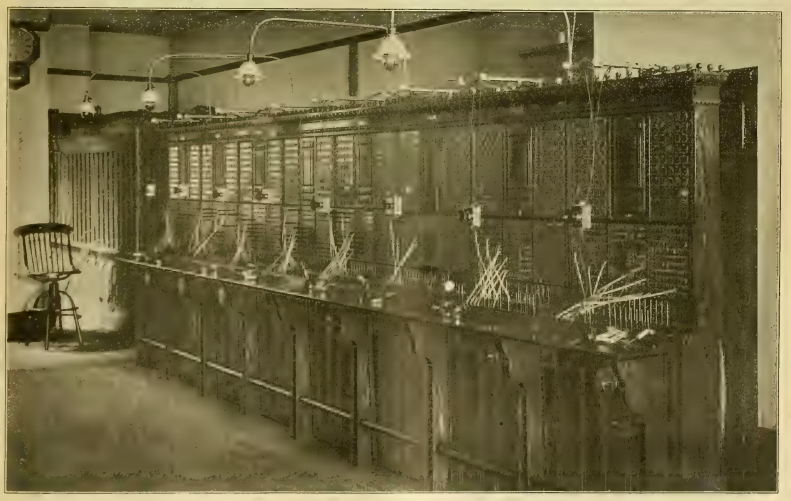
EQUIPMMENT OF KEOKUK, IOWA, EXCHANGE.

Equipment of Keokuk, Iowa, Exchange.

An example of modern telephone-exchange equipment is presented in the accompanying illustration of the operators' room of the Mississippi Valley Telephone company at Keokuk, Iowa. The switchboard was made by the Stromberg Carlson company of Chicago, and has a capacity of 400 subscribers. There are now 350 connected to this exchange, and the service is pronounced thoroughly satisfactory in every particular. The board is simple, swift and sure, with the fewest moves and the shortest distance for the hand to travel. Referring to the cut, it will be seen that the design is compact and handsome, and meets the needs of operators.

Portland, Ore., Exchange.

One of the largest plants installed by the Standard Telephone and Electric company is located at Portland, Oregon. The switchboard shown herewith for this exchange was manufactured over two years ago and has a total capacity of 2,500 numbers. More than half of this number are connected to the board. The exchange has been popular from the first. Both the telephones and the switchboard



PORTLAND, OREGON, EXCHANGE.

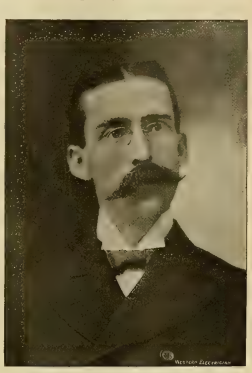
are satisfactory in workmanship and operation. The same claim is made for all the exchanges installed by the Standard company, among which may be mentioned Jacksonville, Fla., San Jose, Cal., Madison, Wis., Marquette and Ishpeming, Mich., and Sioux City, Ia. The board at this point, while furnished through the Standard company, is not of its manufacture; it has, however, given fairly good service, and with some slight modifications which have since been made is still doing good work. Upward of 300 exchanges have been installed by the Standard company.

P. C. Burns.

The president and controlling factor in the American Electric Telephone company of Chicago, Mr. P. C. Burns, got an early start in the business and has since retained his interest in its development. While a mere boy of 15 he started in the business of making acoustic telephones at his father's home under the name of the Vicinity Telephone company, and at 16 was employed by the Bell company as operator and later as inspector in the Chicago exchange. He worked in the factory of the Electrical Merchandise company, which made apparatus for the Bell company, and afterward was sold to the Western Electric company. Then he became a traveling salesman for the Railway Telegraph Supply company, which was later called the Knapp Electric Works.

He started the first electric-supply agency on the South Side of the city of Chicago as agent for the Standard Electric Works of Cincinnati, O., and started the first electrical supply agency in St. Louis —the St. Louis Battery company.

Mr. Burns invented the "microphone" carbon battery, which had a large sale, and disposed of his patents to the New Haven Clock company, now the National Electric Manufacturing company of Milford, Conn. He established and conducted the St. Louis Electrical Supply company, the Findlay Glass and Carbon company, the Peru Electric Manufacturing company, the Laclede Carbon and Electric company (the last two being manufacturers of electric-light supplies) and the American Electric Telephone company of Chicago. He is president of a number of prosperous telephone companies and toll-line companies in different parts of the country, and has had an extended and varied experience in the manufacture of electrical specialties. He has, moreover, been successful in all his enterprises. About 10 years ago he owned the Rose & Rein Electrical Works of St. Louis, and also engaged in the manufacture of apparatus for the Pan-electric Telephone company, having large exchanges at St. Louis, Little Rock and other points, but on account of the vic-



P. C. BURNS.

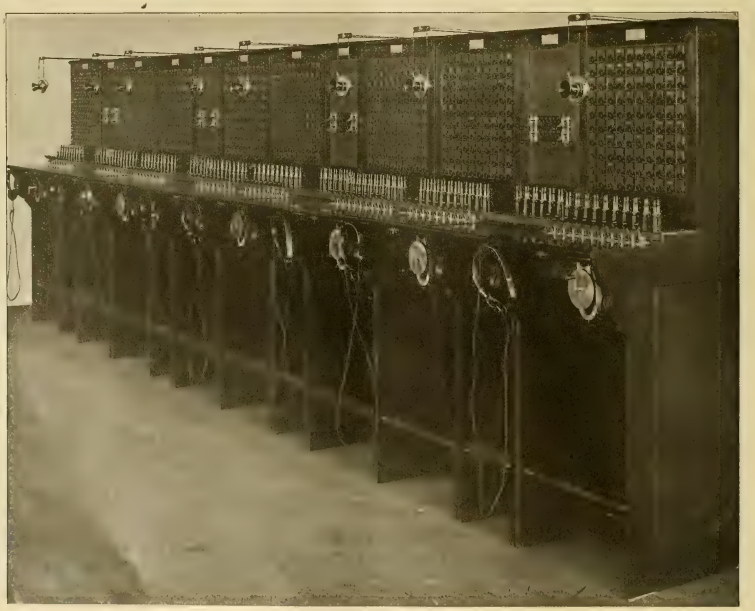
tory of the Bell company on the receiver patent he was obliged to discontinue for a time. He returned to the telephone field, however, as soon as it was open to independent companies. Mr. Burns built the first vitrified porcelain works in the West, the Peru Porcelain Works, for the manufacture of insulators and fuse blocks. He was the inventor of the Laclede and Hercules batteries, and made many improvements in other specialties. He also introduced granular carbon transmitters for sale outright to the trade in this country at least a year before the other companies.

Expansion of Independent Systems.

By H. C. Dodge.

The fact that the independent telephone movement is rapidly becoming national in character is apparent upon examination of late maps of exchanges and territorial lines operated by the independent companies, which show that rapid strides are being made in every section of the Union. In Michigan the city of Grand Rapids represents the center of a district in which the independent companies are strongly intrenched, there being an aggregate of approximately 7,500 telephone stations connected in the district, between each one of which it is possible to communicate in a satisfactory manner. The accompanying map shows lines and connections of the Citizens' State company, Muskegon company, Citizens' Mutual Telephone company and Central Telephone company. In the cities of Grand Rapids, Kalamazoo, Lansing, Muskegon, St. Joseph, Benton Harbor, Holland, and, in fact, all of the principal towns connected, the opposition companies have practically driven the Bell company from the field and are extending their lines at the present time in all directions and are reaching districts which heretofore have not been afforded the benefits of telephone service. This system located in the western portion of Michigan will in the near future be connected with that operated in the eastern district and include territory contiguous to Detroit. It will also be connected with the magnificent opposition systems in operation in the states of Ohio and Indiana, with their hundreds of miles of metallic circuits and important cities equipped with high-class exchanges.

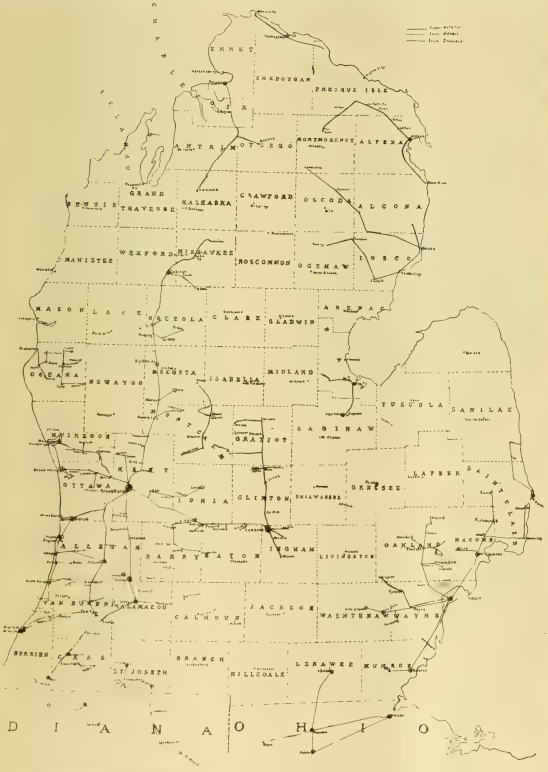
Fortune is smiling upon the promoters of the new companies, whose success has been assured because it has been possible for them to secure apparatus with which they can successfully compete with the best service the Bell company can provide. The necessity for furnishing high-grade equipment has called for heroic efforts on the part of manufacturers of exchange equipment, and that they have been equal to the task has been fully demonstrated by the excellency of appliances turned out. The 800-line express switchboard of the Kalamazoo exchange, shown herewith, fairly represents the highest development of the art of manufacture of high-grade central-station equipment and is the result of extensive experience in making this class of apparatus, the efficiency of which has been fully demonstrated. All requirements for perfect service have been met. These boards are furnished adapted for use in exchanges of any size up to those requiring connec-



EXPANSION OF INDEPENDENT SYSTEMS. KALAMAZOO EXCHANGE.

tion of several thousand lines, and are wired for use in connection with common return or ground circuits or complete metallic circuits, equipped with series or bridging-bell telephones. Trunking apparatus is provided for connection between distant sections, the employment of which assures rapid, simple and reliable method of handling calls of large exchanges. The back of several sections of the express board as wired and connected in a central office lately equipped by the American Electric Telephone company shows great perfection in the matter of arrangement of details. Many installations of equal merit have lately been completed, and in these the distributing boards, combined lightning and fuse arresters and cable-terminal arrangement show the same symmetrical and harmonious plan of arrangement of details as that shown in the cut.

Not only are the independent companies installing perfect city-exchange systems, but the new toll lines are being equipped in an up-to-date manner. Copper metallic circuits are being constructed, properly transposed and balanced as regards their electrical qualities and conditions; highly efficient bridging-bell telephones are being used almost exclusively in connection with such lines, and toll-line switchboards equipped with special appliances required to develop maximum efficiency of service. Repeating coils used are of the highest type. Bridging-bell telephones are equipped with generators having



EXPANSION OF INDEPENDENT SYSTEMS. MAP OF MICHIGAN STATE LINES AND CONNECTIONS.

the required heavy quantity output, combined with ability to ring through high resistance. Ringers have high coefficient of self-induction, making them sensitive to the influence of magneto current. Solid back transmitters of high power and efficiency are being adopted almost exclusively, and with such apparatus procurable, a complete understanding of the requirements called for and a disposition to meet them, the outlook for the continued advancement of the independent companies is highly promising for 1898.

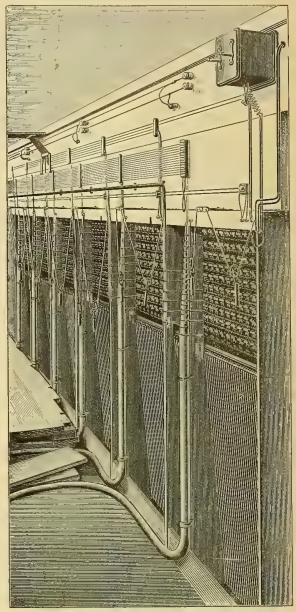
Independent Telephone Movement in Chicago.

The independent telephone movement seems to have reached a stage where its advocates are taking steps to set up shop in such a stronghold of the Bell company as Chicago. Hitherto it has been deemed that the operation of a competitive exchange in this city would be a hazardous undertaking, so well intrenched is the Chicago Telephone company by priority, franchises, occupancy of the streets, financial strength, and, it is fair to add, the skill with which its business is conducted. However, it seems that there are those who are willing to take the preliminary steps, at least, for the operation of an opposition company, although the proposition is surrounded with a certain degree of mystery, so that it is not known to what extent it will be developed.

At the last meeting of the City Council two new telephone ordinances were introduced. One was presented by Alderman Kahler, giving the Independent Telephone company of Chicago a franchise to maintain wires and an exchange in Chicago. The company is required to pay three per cent. of its gross receipts as compensation to the city semi-annually, and is expressly prohibited from selling, leasing or transferring its franchises. The company is prohibited from charging more than $75 per annum for each telephone for the first year and $70 for each year thereafter. In cases where contracts are made for three years or more the maximum charge is $65. The company is required to furnish all the departments in the city hall telephone service free of charge and to furnish the city fire and police telephones at $1 each. By the provisions of the ordinance the company must have 2,000 instruments in operation on and after January 1, 1902.

Alderman **Kahler** refused to give any information as to who was behind the company, but he said it was projected by Chicago capitalists who had plenty of money.

The other ordinance was introduced by Alderman Kimbell and gives to S. J. Haefield, his associates or successors, the right to establish 50 long-distance telephone stations in the city of Chicago and to operate wires in connection therewith. According to the provisions of this ordinance, Mr. Haefield must pay five per cent. of the gross receipts to the city of Chicago. Alderman Kimbell declared that the company was backed by large lumber interests in



EXPANSION OF INDEPENDENT SYSTEMS—WIRING OF BACK OF SWITCHBOARD.

Wisconsin, and that it already had lines in operation in that state. According to Alderman Kimbell, Mr. Haefield is only the superintendent of the company at Menomonie, Wis., and is not one of the capitalists interested. Both ordinances were referred to the committee on gas, oil and electric light.

Keystone Telephone Company.

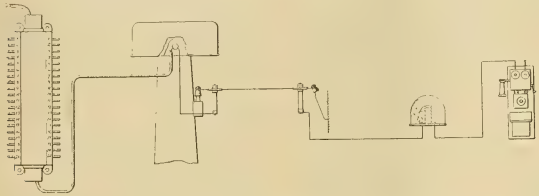
The Keystone Telephone company of Pittsburg has progressed so rapidly during the last year that it is now counted among the leading telephone manufacturers in the country. Its telephone apparatus is among the high-priced goods on the market, but it is nevertheless desirable to purchase, inasmuch as it is guaranteed to give lasting and good service without necessity of repairs. The company's switchboard apparatus is considered equal if not superior to other switchboards, and is of such importance that this department of the factory is crowded to its utmost capacity at all times. The company is so busy that the factory force has been compelled to work till 9:30 p. m. every day in order to keep pace with increased trade. A large portion of the Keystone company's business has been done with exchanges that have been fitted with other telephones. Many recent contracts have been made, among them the 900-drop switchboard for the Youngstown Telephone company, Youngstown, Ohio, a 400-drop full metallic switchboard for the Home Telephone company, Oskaloosa, Ia.; a 300-drop system for the Uniontown Telephone company, Uniontown, Pa.; a 300-drop system for the Connellsville Telephone company, Connellsville, Pa., a 200-drop system for the Scottdale Telephone company, Scottdale, Pa., a 100-drop system for the Wellsburg Telephone company, Wellsburg, W. Va., a 200-drop system for the Moundsville Telephone company, Moundsville, W. Va., and a 300-drop system for the Washington Telephone company, Washington, Pa. Besides these complete systems, the

company is furnishing large numbers of long distance telephones which are guaranteed to have no superior and few equals in the market.

Telephone Protective Devices.

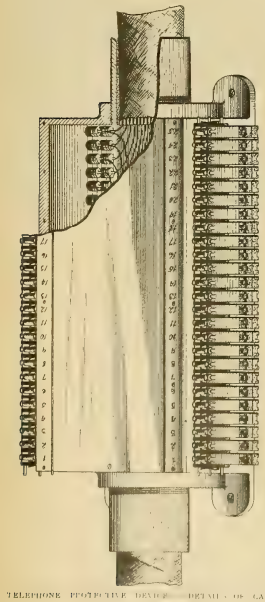
The system of protecting telephone cables and apparatus illustrated in the accompanying cuts is manufactured by the Sterling Electric company of Chicago.

The combined cable terminal and protector is made in sizes from 25 to 100 pairs of wires. The box is of iron and brass, with springs mounted upon the outside. The aerial or underground cable en-



TELEPHONE PROTECTIVE DEVICES.—DIAGRAM OF COMPLETE SYSTEM.

is taken to a spring in contact with a block of carbon. This block is separated from another similar block by a perforated mica plate. The latters at one end of the terminal, passes thence to the outside row of connectors, and from these a branch carbon is held in place by a spring connecting with ground, the surfaces of the two carbons being separated only the thickness of the mica, which is .005 of an inch. This branch circuit, including the carbon blocks, constitutes the lightning arrester. Imbedded in the surface of each of the carbon blocks is a small metal or carbon ball held in position by easily fusible wax. The passage of a current of a high potential from one carbon block to the other cre-

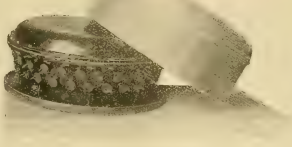


TELEPHONE PROTECTIVE DEVICES.—DETAILS OF CABLE TERMINAL AND PROTECTOR.

ates an arc, which heats the carbon in a few moments sufficiently to melt the wax and release the balls, which fall by gravity, thus leaving a direct connection between the two blocks of carbon. This is one of the features of the disappearing protector. From the same connectors there is an circuit passes to the line spring, thence through a heating coil to another spring which is connected to the wire leading to the distributing board. This heat coil is composed of a number of windings of German silver wire upon a V-shaped metal spool, which is in two parts, united by fusible solder. Upon the passage of even a very slight current, such as .16 ampere, the coil becomes heated, the solder melts and releases the two parts. This allows the two springs to fly back and make connections, the line spring direct to ground, while the spring on the switchboard side closes a circuit which automatically sounds an alarm and calls attention to the break. This is the sneak-current feature of the protector.

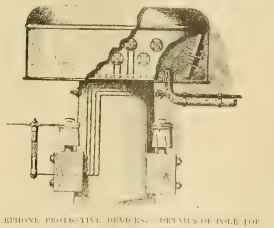
To protect the cable itself against injury, a line fuse is provided. It is a pair of connectors mounted upon either end of a piece of enameled wood tubing about four inches long and one-half inch in diameter. A fuse wire of about five-ampere capacity uniting the connectors through the wooden tube, which is hermetically sealed, prevents any damage from the weather. This fuse is placed at the outer end of the cable and is operated by the action of either the sneak-current or the strong current protector, which causes the fuse to blow whenever a current dangerous to the cable passes over the line fuse.

The pole-top terminal is made up in sizes of 25 to 100 pairs of wires, is of solid iron in three parts and circular in form. It is placed directly upon the top of the pole, which has first been sawed



TELEPHONE PROTECTIVE DEVICES.—VIEW OF POLE-TOP TERMINAL, COVER REMOVED.

square. The cable is brought into the terminal from the bottom, the lead cover being stripped back and the wires spread to connecting points. These connections appear upon the inside of the terminal through hard-rubber bushings, and correspondingly upon the outside of the terminal. The bushing is secured through the terminal in a permanent and air-tight manner, the connections through the bushings being numbered consecutively upon the bottom piece of the iron casting. From the outside

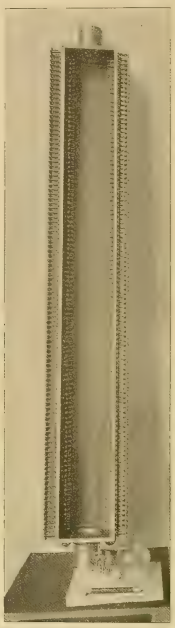


TELEPHONE PROTECTIVE DEVICES.—DETAILS OF POLE-TOP TERMINAL AND LINE FUSE.

connection upon the rubber bushing a spider wire is carried to the line wire upon the cable pole. The cable in the terminal, where it comes into the same, is soldered in place. A rubber gasket is used to make an air-tight joint between the body casting and the lid casting of the terminal. Outside and over all of these is a one-piece copper cover which fits down closely over the entire terminal, being slid into place by the rubber gasket, making it absolutely safe from any weather.

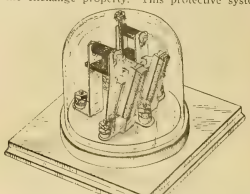
Before sealing either the terminal and protector, or the pole-top terminal, there is placed within the case four or five pounds of quick-lime which absorbs every particle of moisture within the terminal.

The two-wire protector to be used at the subscriber's station is assembled upon a porcelain base, covered with an oval glass case. It consists of



TELEPHONE PROTECTIVE DEVICES.—VIEW OF CABLE TERMINAL AND PROTECTOR, ALSO TWO-WIRE SUBSCRIBERS' PROTECTOR.

heat coils between two tension springs, one side of the spring also going to a carbon and mica arrester, similar to that used upon the cable terminal and protector already described. The heat coil operating at .16 ampere throws the line to ground and opens one side of the circuit. The line fuse is used upon the outside of the subscriber's station and operates in connection with the two-wire protector in a manner similar to the combined terminal and protector. This gives the subscriber's apparatus and premises exactly the same protection as the exchange property. This protective system



TELEPHONE PROTECTIVE DEVICES.—SUBSCRIBERS' TWO-WIRE PROTECTOR.

is the only one that has been approved and endorsed by the National Board of Fire Underwriters, except one owned by the Bell company.

The switchboards, transfer boards and cross-connecting boards manufactured by the Sterling Electric company are practically the same as those the Bell company is now using. This is quite an innovation in the independent telephone field, and one that can be appreciated by operating as well as construction companies.

Western Telephone Construction Company.

The Western Telephone Construction company of 250 South Clinton street, Chicago, reports the largest business in its history. Its factory has been doubled in size and quadrupled in capacity within the past year. It has now a complete nickel-plating plant which is taking care of the entire work in this branch.

Fig. 1 illustrates the company' standard long-distance telephone instruments, which, it is claimed, "speak for themselves" if one will only give them a trial. This instrument is equipped with a very powerful magneto generator and call bell and is designed either for bridged or series work. The hook switch is of the Western type but has been recently greatly

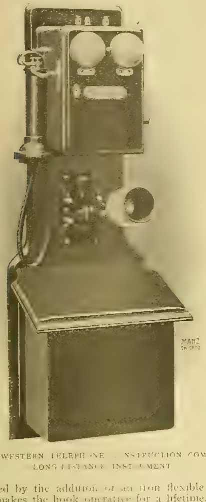


FIG. 1 WESTERN TELEPHONE CONSTRUCTION COMPANY LONG-DISTANCE INSTRUMENT

improved by the addition of an iron flexible shoe which makes the hook operative for a lifetime. All contact points on the switch are platinum-pointed, thus insuring complete immunity from corrosion. The receiver is the well-known bipolar type, and the transmitter is of the granular carbon long-distance type mounted on a handsome enameled iron arm, which is, in turn, mounted on a base of soft cast-iron in which is encased the long core induction coil. This coil is wound on a spool of red fiber and encloses a very heavy core of fine Swedish iron wire; both primary and secondary are of silk and the coil is particularly adapted for use with this transmitter. These instruments are made with single, double or triple cell battery boxes, and are finished in either oak, walnut or cherry, and, in fact, on special order, in any special wood obtainable. The complete telephone equipment of the Astoria Hotel was recently furnished by this company, all of the instruments and switchboards being made in solid mahogany.

Fig. 2 shows one of four types of cabinet desk telephone sets, which is made in cherry and is provided with a plate glass carrier. The telephone parts are of the same kind as used on the wall set, but, of course, are differently mounted. The other three types are equally handsome and each is particularly fitted for a certain class of work.

Logansport Mutual Telephone Company.

The Logansport Mutual Telephone company is owned and managed by L. B. Overshiner. The exchange was built in 1895 and started with 182 subscribers and without a single outside connection. It now has over 900 subscribers, and 250 outside towns and cities in Indiana and Illinois are connected by toll lines. The Bell company has placed the service at 75 cents per month for residences and $1 per month for business houses, and in several cases given service free. The express switchboard of this company makes possible quick, reliable and satisfactory service, and the simplicity of the board at once commended it to the owners and managers of telephone exchanges. The board has been manufactured one year, and in that time many have been placed in Indiana. The Logansport company has arranged to string about 8,000 feet of cable early in the spring and extend quite a lot of toll lines. Toll line business is good.

Influence of Organization in the Independent Telephone Movement.

By James M. Thomas

Organization is necessary for the best success of any business. This is axiomatic and will, therefore, be accepted without argument, as applying to the independent telephone movement. The first step toward effecting the organization of operators of exchanges was held in Newark, Ohio, in February, 1895, and was attended by a few gentlemen who had been drawn together to inspect the exchange of the Newark Telephone company, which had just been opened. After a full discussion of the business and its future prospects, it was agreed that, to bring about the greatest success, an organization should be formed to watch and promote the interests of all operating companies, believing that a state organization would encourage the building of other exchanges. So a call was issued to all the companies then organized in Ohio to meet in Columbus for the purpose of discussing the advisability of such an organization.

In pursuance of this call quite a large number of delegates attended, and a very interesting discussion of everything pertaining to the good of the movement was listened to by those present. This meeting, which was held in April, resulted in the organization of the Independent Telephone Exchange association of Ohio, which has ever since existed.

The rapid development of the movement in Ohio is due to this organization, as it attracted the attention of the people to the fact that the undertaking was meeting success wherever attempted. Frequent meetings were held and the press of the state gave notice of the movements of the independents, though no encouragement was offered until the movement had attained more portentious magnitude, as shown through this organization.

Indiana and Western Pennsylvania followed the

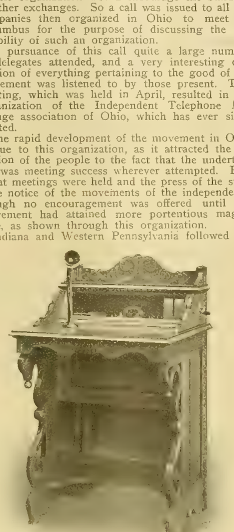


FIG. 2 WESTERN TELEPHONE CONSTRUCTION COMPANY. CABINET DESK SET.

example of Ohio in organization, through the efforts of gentlemen residing in these states, who had attended the meetings of the Ohio association. After the organizations in those states a joint committee was selected, composed of members from Pennsylvania, Ohio and Indiana, which took up the work of a general organization, together with other important matters of general concern to all who were anxious to promote the interest of the independent telephone movement.

This joint committee met at the Hotel Imperial, New York, last March and after conference and much labor formulated a plan for general organization. The committee met again in Columbus, Ohio, in April, and in March met in Fort Wayne, Ind., with many gentlemen from different parts of the United States, and directed a call to be issued for a meeting of all operators for the purpose of forming a general organization for mutual benefit. But before this call was issued, another had been sent out for a convention to be held in Chicago in May. This brought together a large number of delegates, and after a temporary organization it was agreed to issue a general call for the purpose of organizing an association of all operating companies in the United States, to meet in Detroit on June 22d.

The Detroit meeting attracted universal attention and the press of the country gave much space and a great deal of encouragement to the movement, whereas previously the tendency was against the movement.

Many states immediately after the Detroit convention took up the work of organization, with the result that at present most states in which the movement has found a foothold have flourishing state associations.

Having given a very brief outline of the history of the organization, I pass now to the consideration of its influence in the independent movement.

The direct result of organization is promotion. The rapid growth of this movement is due to the fact that those who have invested their money depend upon intelligent organization to preserve and foster their investments and place within their power the facilities of competing, to advantage, with our rivals in this field. This is the secret of the success of this movement. The American Bell Telephone company and its lessees have, since this movement started, through their agents and managers, tried to convince the people that the investors in independent exchanges are fools and have been duped by the manufacturers of independent apparatus, who have deceived them in order to sell their product. This is not the reason for this movement, and this argument has proven a failure; something has made it grow in spite of all threats and misrepresentation, and the people fully realize that the movement is not in the hands of fools or dupes.

The immense wealth of the American Bell Telephone company made it necessary that a general organization should be formed. It would not have been wise to attempt to fight a corporation with its allies so well intrenched without an organization ever watchful and alert.

The independent telephone movement is in this brief time of its existence better organized than most commercial enterprises of similar character. The operators are in touch with each other, and the knowledge of those of great experience is sought through this organization by those of less experience. Correspondence has become voluminous, and the movements of a company in California or elsewhere are soon known by all. The work of organization, however, is just begun, and must be perfected rapidly if this movement shall attain its highest possibility.

Effective state organization must be kept up to watch matters of local concern, such as taxation and legislation generally. The legislatures of the several states are very busy with proposed laws of all kinds, affecting the independent telephone interests—some good and some bad, and some appearing good at first thought, but bearing within them dangers to this movement. The state organizations are watching these proposed laws, and in states where an organization has not yet been formed a meeting should be called at once for that purpose.

The Independent Telephone Association of the United States of America watches and promotes the business generally, but cannot effectively reach the legislatures of the several states. Local organizations can do this.

This organization has now reached a point where the demand for intermunicipal connections calls for a general company with sufficient capital to connect the independent companies into one system. Many long lines are now built by companies covering certain territory.

The general company with ample capital is in sight. This new organization is going to succeed

L. B. OVERSHINER.

because "Better facilities for long-distance services at a rate within reach of the majority of the people" is inscribed upon its banner.

Telephone Literature.

An interesting contribution to the literature of telephony is a publication of the American Electrical Engineering association, entitled "Patented Telephony." It is a review of the patents pertaining to telephones and telephonic apparatus, and is intended for reference for investors and inventors, engineers and attorneys engaged in telephony. It is claimed that there are now 4,000 United States patents which cover apparatus and improvements in telephony. Of course only the salient features can be covered in a treatise of this kind. The work is profusely illustrated, and a very good index accompanies it.

The "Telephone Hand Book," published by the Electrician Publishing company, is the most comprehensive and practical work obtainable to-day, as it covers the field concisely and contains valuable information for inventors, engineers and operators, in fact everyone interested in the telephone industry. A new edition of the work has just been issued.

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In magnitude and vitality the independent telephone movement in this country to-day surpasses the fondest hopes of its most earnest advocates. It has spread with wonderful rapidity, especially in the enterprising western cities and villages which had been entirely neglected previous to the advent of the opposition companies or subjected to the ordeal of higher prices and less modern service than now prevail. Those who enjoy the superior advantages of modern Bell equipments for large cities cannot fully appreciate the eagerness with which the residents of smaller towns greeted the advent of an opposition company offering a service, correspondingly as good; but it is only necessary to understand the condition of the country generally in the way of telephone service at the inception of the independent movement to realize the extent of the field that was opened up by the expiration of the fundamental Bell patent. This field has been assiduously cultivated ever since, many of those engaging in the independent movement having gained their experience with the old concern and being thoroughly alive to the opportunity and demand awaiting them. Naturally, they have profited by the mistakes of their old masters; they are cultivating public favor, and the popularity of their course is everywhere indisputably attested.

In this issue of the Western Electrician an effort has been made to give some idea of the character, extent and scope of the movement, particularly the manufacturing and construction interests. Typical exchanges are illustrated and representative apparatus is shown and described in detail. An examination of these features affords convincing evidence that standards have been established in no way inferior to the best Bell practice. This, of course, has had much to do with the success of the movement. It may surprise some who have not followed the matter closely to learn that already an intercommunicating system has been established between the cities and villages in many localities, and that the idea is likely to be developed still further. When it is considered that there are in round numbers in the neighborhood of 2,500 independent exchanges in operation in the United States to-day, the possibilities of such a system will be better understood. The outlook is certainly promising, and, judging from the record already established by those identified with the opposition interests, there is every reason to anticipate a splendid future for the independent telephone movement.

In recognition of the splendid advancement that is being made in the independent telephone field, technically and commercially, and in order to better serve the demands of this growing class of electrical workers, the Western Electrician will hereafter present each week in a special telephone department the latest achievements, inventions and modifications in telephone apparatus, as well as the commercial news pertaining to this branch of the business. A special feature will be made of contributions upon practical subjects, prepared especially for workers in this field.

Uniformity in diagrammatic representation of electrical apparatus would doubtless prevent much confusion, and the establishment of a code is for many reasons greatly to be desired. The Chicago Electrical association has prepared a set of diagrams which it offers for approval. The drawings are presented on another page of this issue, together with the suggestions and explanations of the committee which compiled the report. They should be carefully scanned and considered. No doubt those who are actively engaged in designing apparatus and are brought constantly in touch with the Patent Office will appreciate the efforts of the association and give the subject careful attention. It is not to be expected that the proposed diagrams will meet the views of all, and it may be found desirable to make some changes and additions. The subject will require much thought and discussion before the general adoption of any plan can be hoped for.

One of the most decisive victories scored against the advocates of municipal lighting plants is reported from Tonawanda, N. Y., where the proposition to bond the village for $25,000 to build a lighting plant was submitted to the taxpayers. The total number of votes cast was 403, out of which 339 were opposed to the proposition and only 64 in favor of it.

An electrical gathering of more than usual interest is that planned for Laredo, Texas, on March 9th, 10th, 11th and 12th. It will be an international meeting of the Gas and Electric Light association and the Street Railway association of Texas with a number of Mexican gentlemen engaged in like pursuits. Laredo is a city of about 12,000 inhabitants, situated in Southern Texas, on the Rio Grande River. Its principal railways are the International and Great Northern and the Mexican National. The gentlemen in charge of the convention say that the hotel accommodations are ample and that exhibits will be well taken care of. Special low rates of railroad fare have been secured on the International road, and a good attendance is expected. An elaborate programme of papers has been arranged, and provision is made for excursions across the river into Mexico and to other near-by points of interest. To a man in Chicago or New York Laredo seems a long distance away, as indeed it is; and it is encouraging to note the activity and energy of our southern electrical friends. This progressiveness is the hall-mark of the electrical industry everywhere. We wish for the Texan and Mexican electrical men a convention of real usefulness as well as a pleasant social gathering.

It is the common belief that inventors as a class are poor business men—the better the inventor, the poorer the business man—and it must have been upon this assumption that Representative Reeves acted when he introduced his bill in Congress which has created such a stir among inventors and manufacturers alike. Doubtless when he conceived the idea the Illinois congressman thought he was conferring a benefit upon a down-trodden class, but by this time he must feel that they are very ungrateful. At any rate inventors and manufacturers are making vigorous protests against the passage of the Reeves bill which, according to its author, is intended to amend the patent laws of the United States so as to allow the more reasonable use of inventions and discoveries by the people and to protect the patentee. The bill empowers the commissioner of patents to place a tax of from one to 10 per cent. of the cost of production upon articles manufactured under patents granted under the act, such tax to be paid into the Patent Office. The bill also reserves to the United States the right to condemn patents at a fair cash valuation when it can be shown that the invention is of a character to be valuable to the people as a whole. It is pointed out by those opposed to the measure that the proposition to give the commissioner of patents the right to fix the amount of royalty to be paid on an invention is a distinct invasion of the rights of an inventor and of manufacturers as well, and it is contended that it would be simply impossible for an inventor to interest capitalists in his discoveries and inventions if manufacturers generally were allowed to make the patented article. The execution of such a scheme as that proposed by Mr. Reeves would require a revision of the laws of trade, and inventors would be placed absolutely in charge of the commissioner of patents. Furthermore, it is pointed out that it would be a radical error to curtail the use of patents by imposing a tax upon the manufacture of patented articles or the use of patents in manufacturing industries.

Art of Constructing Telephone Apparatus.[1]

By H. F. Clausen.

This paper should not be considered a guide for the telephone manufacturer, but merely a general review of what is being done by builders of telephone appliances.

Prior to Prof. Bell's discovery of the magneto-electric telephone the so-called "string telephone" was the only popular means of transmitting speech to a distance, but under the most favorable conditions only was it possible to successfully operate systems up to two miles in length. For circuits, however, exceeding 1,000 feet in length the mechanical telephone is capable of giving a cheaper and more satisfactory service than the best magneto-electric telephone yet produced, assuming of course that the local conditions are favorable.

The limiting distance at which mechanical telephones may be operated is prescribed by the kind of wire and supports employed, and more often by the extreme variations of the temperature. Briefly, when a circuit exceeds a certain length the capacity becomes great enough to defy all attempts at giving practical service; again, if the wire is improperly supported retardation proves a second evil, and if there is more than one circuit supported on the same poles the ever-present bugbear cross-talk ends all pretense of maintaining anything like a satisfactory service. Among the 175 patents granted to inventors of acoustic-telephone apparatus may be found some very interesting reading matter relating to mechanical telephony, for the designs cover transmitters, receivers, supports, signals, switchboards, repeaters and many other appliances common to the electric telephone of to-day.

The United States Patent Office has granted more than 3,000 patents on apparatus pertaining to the art of telephony, nearly 300 patents alone being on modifications of Prof. Bell's magneto-telephone discovery.

In view of the enormous number of different designs in actual use the author will make no attempt to describe more than one instrument of a class of apparatus. Furthermore, the instrument described should not be considered as representing the most advanced grade of manufacture, selected as the instruments were merely for the purpose of illustrating general principles employed without any special reference to their comparative merits.

In Fig. 1 A and B represent two telephone instruments connected together electrically by means of the wire W and the earth connections G and G'. The combination illustrates what is known as a ground-return telephone circuit. In Fig. 2, stripped of all confusing details, the circuits of an ordinary exchange telephone are shown, representing diagrammatically the several operative elements. Referring to the telephones shown in Figs. 1 and 2 we will divide them into eight sections, thereby allowing a more general description—the call transmitter C T, the call receiver C R, the speech transmitter S T, the speech receiver S R, the transmitter battery T E, the induction coil I, the circuit-controlling switch C C and the wood-case details W D.

The call transmitter C T is a magneto-electric machine arranged for generating an alternating current. The gear wheel G and G' are proportioned about 6 to 1—that is, if by means of the crank C the gear wheel G is turned at the rate of two revolutions per second, the armature A will revolve at the rate of 10 revolutions per second. Regarding the proper speed at which the armature should be driven, an average speed of 500 revolutions per minute is the usual practice; the speed should be governed, however, by the kind and construction of the apparatus it is intended to operate.

Referring to Fig. 4, we have a sectional view of the armature A, showing in detail the wire space A W, the contact pin A C and its rubber bushing C B. The wire space A W after having been thoroughly insulated is usually wound to about 500 ohms with 4,500 turns of No. 34 B. & S. gauge wire, 2,250 turns on each limb, it being understood, of course, that the windings may be varied to suit predetermined requirements. The hand-driven magneto generator, as it is employed in telephony, requires a class of construction producing the highest possible figure of efficiency. The permanent magnets employed must be made of the best magnet steel thoroughly hardened and carefully magnetized. The iron used in the construction of the armature and the pole-pieces P and P', Fig. 5, should be of the softest obtainable. In a well made generator the air gap between the face of the armature and the pole-pieces should be less than 20 mils. As a matter of fact an air gap of 12 mils can be produced and made to give practical service for a long time, limited only by the natural wear of the armature bearings.

There is also a fixed rule regarding the relative dimensions of the armature limb towards the pole pieces, as indicated in Fig. 5 A, the armature should just fill the space between the pole pieces P and P'. When in a horizontal position the space C in the pole piece should no more than exactly cover the armature limb. Briefly, in the first instance if the armature does not quite fill out the space between P and P' its polarity will not be quickly reversed. Again, if more than exists the space—that is, laps under on both sides, the armature never fully reaches its highest possible point of magnetization. In view of the foregoing it will appear obvious that the armature limb should just fit into the space C, Fig 5 B, for if it be too small no current would be generated during the time that both sides of the limb are covered by the pole-pieces. A less complicated, though equally important, piece of apparatus is the magneto ringer. Referring to Fig. 6, we find it is composed of a permanent magnet P M, the wire spools C and C' and the centrally pivoted armature A. The permanent magnet P M is a U-shaped piece of steel magnetized so as to produce a north pole at M and south poles at X and X'. Arranged as it is, however, with the iron connecting frame F, to which are attached the polar extensions S and S', the X and X' points in reality become neutral, whereas the extreme upper ends of the cores S and S have imparted to them a strong south polarity. The armature A, being thus placed directly in the path of the magnetic lines flowing from N to S and S', becomes polarized in a rather peculiar manner. A careful examination, however, will prove that it is the north polarity which predominates, but the actual polarization is so evenly distributed that the armature when examined appears to be almost neutral.

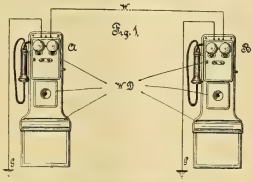
For regular local-exchange service each coil of the ringer need not be wound with more than 2,000 turns of single silk-covered copper wire 12.64 mils in diameter, with both coils connected in series we have then a total of 4,000 turns and a resistance of 41 ohms. When a common return or grounded system is employed, even if less wire is used on the ringer coils, it would prove more effective as a safeguard against burnouts. It would not, however, be good practice to install a magneto ringer which does not at all times respond to a generator current through a non-inductive resistance of much less than 7,000 ohms. With the current generated by the magneto generator described in a preceding section it is possible to make the ringer armature A (Fig. 6) respond to an impulse of current over 20,000 ohms of non inductive resistance.

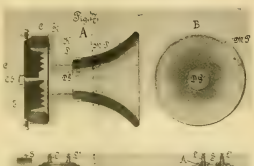
The receiver supporting hook C C (Fig. 2) is an automatic switching device, operated by the weight of the receiver and the connecting spring S. Normally, that is, with the receiver on the hook, the line circuit is closed through the call receiver and around the shunt wire of the call transmitter C T. Upon removing the receiver the counter spring S forces the hook up and in contact with two springs B and B T, closing respectively the battery circuit through the microphone and the primary winding of the induction coil and the line circuit through the secondary winding in series with the speech receiver S R.

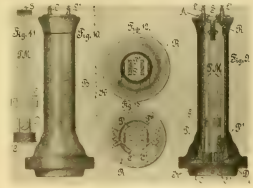
The movable parts of a telephone hook should be made fairly rigid, for when it is considered that the switch must perform its functions always, though exposed to the probable abuse of the sometimes wrathy telephone user, it will be understood why some of the samples submitted herewith do not always appear presentable, especially after cutting in a line bristling with wrath-producing things.

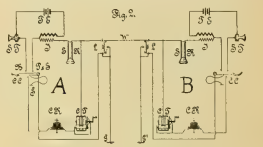
The speech transmitter or microphone S T shown in Fig. 7 is of the simplest type imaginable. The hard rubber cup C supports a carbon electrode E. The metal cap K, fining over the cup C at R, holds in place the carbon diaphragm D. The variable resistance material, carbon, is maintained in a loose or divided state between the electrodes E and D.

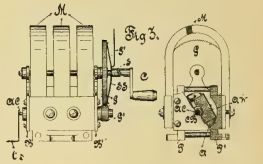
In the construction of a microphone the object is

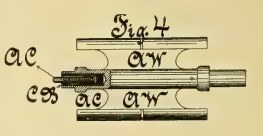


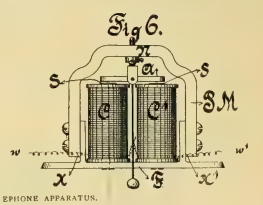












ART OF CONSTRUCTING TELEPHONE APPARATUS.

with a given air disturbance to obtain the largest possible variation in the amount of current passing through the primary winding of the induction coil. The microphone in response to air vibrations acts as a rheostat in series with the primary winding and the battery T E.

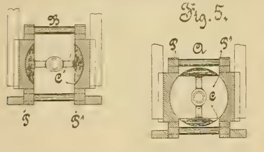
Lack of time will not permit of a very lengthy description of the microphone. Let it suffice, therefore, to say that after once you have succeeded in constructing a good talking microphone let well enough alone, and rather than attempt to make a different instrument devote your spare time to improving the little unknown details of the good talker, and above all remember that the least change in either construction or kind of material employed may mean the undoing of all former efforts and the loss of a one-time good talking transmitter.

The induction coil consists of three essential parts: the iron core, the primary winding and the secondary winding. The iron core should be constructed from thoroughly annealed iron wire about 20 mils in thickness. A somewhat smaller wire might be more desirable were it not for the difficulty experienced in handling much smaller wires. The primary winding of an induction coil should consist

[1] Read before the Chicago Electrical Association January 21 1898.

of no more than three layers of single silk-insulated copper wire, and that only on coils less than two inches in length.

There is, however, no fixed rule regarding the number of layers actually required, for the kind of microphone and battery employed will generally help to determine the proper proportions. The secondary winding of an induction coil should be wound with no more turns of wire than are absolutely necessary to give a good secondary effect. In other words, if an induction coil having but 20 turns in the secondary winding gives you the desired service do not wind it with 10 times the number of turns merely for the sake of appearance.



ART OF CONSTRUCTING TELEPHONE APPARATUS.

As stated, the proper dimensions of an induction coil must be determined with a given microphone and battery employed. Assuming, therefore, that we have a source of current with an electromotive force of three volts, also that we have a microphone constructed similar to the one shown in Fig. 8, and that it be desired to design an induction coil suitable for both local and long-distance transmission; although this paper could not begin to describe the numerous experiments performed or how the proper proportions were arrived at, the induction coil which will be described may be said to be the fruit of seemingly endless experiments made in connection with the apparatus already mentioned.

The iron core is composed of 500 strands of No. 24 B. & S. gauge Swedish iron wire four inches in length and formed into a bundle nine-sixteenths inch in diameter. Immediately surrounding the wire bundle, fitting very closely, is a fiber tube one-thirty-second inch in thickness. At both ends of the tube a square fiber head is securely fastened, for the double purpose of holding the primary and secondary wire in place and to allow fastening the completed coil to the proper support.

The primary winding consists of 200 turns of single silk covered magnet wire 32 mils in diameter wound in two layers to a resistance of .038 ohm. After covering with several layers of waxed paper the wire thus wound, the secondary winding consisting of 1,400 parallel turns of single silk covered wire 6.30 mils in diameter is wound over the primary wire in seven layers to a resistance of 75 ohms. In concluding this section it might be said that a large number of coils constructed according to the foregoing specifications are in daily use, and that a demand has yet to be made which it cannot meet and prove equal to in a comparative test.

The magneto telephone, after more than 20 years of service, has yet to meet a successful rival. It has been subject of scores of patents and modifications, but somehow or other the old-fashioned horseshoe magnet with a pair of magnet coils upon its polar extremities appears to be the proper thing to place behind a kinkless diaphragm.

The hand telephone is so well known that a description of it may be made very brief, and for that reason the author selected for illustration a receiver which he has good cause to believe was made [illegible] spectively show a top and bottom view of the receiver with the ends removed, allowing better inspection.

Numerous statements have been made relating to the extreme sensitiveness of the telephone receiver, but the next time you figure on buying a complete telephone outfit, test the telephone in the ordinary way with the slight addition of a two-ohm non-inductive shunt coil connected in multiple with the receiver terminals. If it stands the test the instrument should give good satisfaction as a talker.

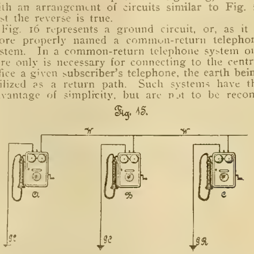
Fig. 14 represents three telephones connected in series. Although it is possible to give fairly satisfactory service with the telephones constructed as described in Figs. 3, 4, 5 and 6, it is always advisable to wind a less number of turns of wire on the ringer spools and a greater number of turns on the generator armature, the former to reduce its retardation to the voice currents and the latter to make up for the decreased sensitiveness of the magneto ringer.

Fig. 15 represents the connections of the bridged-circuit telephone, largely employed for party-line service. Whenever it is desirable to permanently connect more than two telephone instruments to one wire circuit the instruments may be connected as shown in Fig. 14, but with the properly arranged instruments connected as shown in Fig. 15, a much better talking service is had, which more than counterbalances the somewhat decreased efficiency in calling distant stations.

In explanation of this comparison it might be said that with instruments connected as shown in Fig. 14 the talking limit is reached long before the limit in distance of practical signaling, whereas with an arrangement of circuits similar to Fig. 15 just the reverse is true.

Fig. 16 represents a ground circuit, or, as it is more properly named a common-return telephone system. In a common-return telephone system one wire only is necessary for connecting to the central office a given subscriber's telephone, the earth being utilized as a return path. Such systems have the advantage of simplicity, but are not to be recommended under adverse conditions for producing a satisfactory service.

Fig. 15.



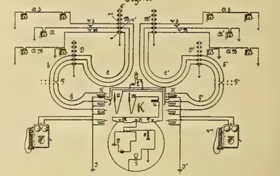
ART OF CONSTRUCTING TELEPHONE APPARATUS.

It is not within the scope of this paper to give anything like a complete description of any particular system, but for the purpose of illustrating general principles employed, the common return, as the simplest of all systems, has been selected by the author for the purpose of describing to you what details enter into the construction of an exchange system, and what constitutes the a b c's of a telephone call.

The telephones A S, A and A B represent instruments already described in another section. Assuming that a subscriber at the telephone A wishes to have his line placed in connection with the circuit connected to the telephone A S, one turn of the generator crank will be fully sufficient to throw [illegible] posite, the wave discovered and attempted to reach a ground plate quite near to both spring clips. Passing into the cable C there appeared to exist an endless rush of strange-looking waves of all sizes, some long, some short, and all were persistent in demanding a passage, resorting even to traveling in an entirely unprofessional manner on circuits belonging to others. Confusion reigned supreme. The motto was "Everyone for himself and induction for us all."

On emerging from the cable C at D the heat

Fig. 16.

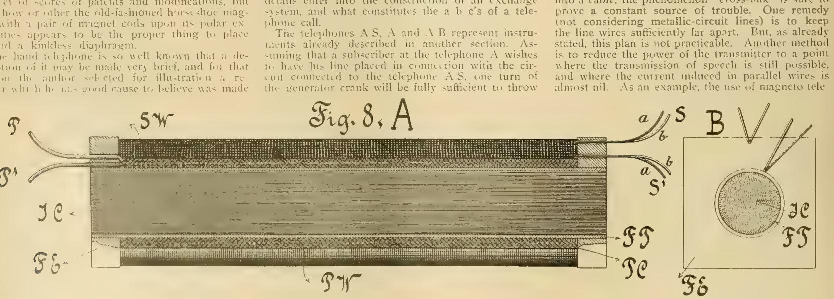


ART OF CONSTRUCTING TELEPHONE APPARATUS.

coil was passed without a struggle. Rushing through the cable E the now somewhat flattened wave received a severe jolt while effecting a passage through the distributing board F. However, with a last and supreme effort the wave performed its mission by passing through the wire of the annunciator magnet H, and over the earth wire I back to its source, the telephone A.

For the purpose of a more extensive description we will follow the path as outlined by the current wave. The telephone A and the line wire W it will not be necessary to further describe. At the point B there is placed on the cable pole a waterproof box containing the terminal end of the cable C, a lightning arrester strip b' and the spring clip terminals w w' and c c', which are connected together by means of fusible wire W C. The wire of which the cable C is constructed will not, as a general rule, safely carry more than five amperes of current. Therefore if any outside telephone wire accidentally comes in contact with a wire charged with a sufficiently high difference of potential the fuse wire W C must open the circuit and protect the cable wire against the passage of more than five amperes of current. Bear in mind, however, that it is the cable wire and not the wire on the annunciator drop we are protecting.

Regarding the cable C, nothing of much importance can be said outside of that which the "much troubled" wave called unprofessional traveling, by which it is meant to say that both ringing and voice currents passing over certain wires cause an induced current to travel in all wires lying closest to itself. The voice currents, however, most seriously affect single-wire telephone systems, for as it is at times impossible to install an exchange system without the use of at least some wires formed into a cable, the phenomenon "cross-talk" is sure to prove a constant source of trouble. One remedy (not considering metallic-circuit lines) is to keep the line wires sufficiently far apart. But, as already stated, this plan is not practicable. Another method is to reduce the power of the transmitter to a point where the transmission of speech is still possible, and where the current induced in parallel wires is almost nil. As an example, the use of magneto tele-



ART OF CONSTRUCTING TELEPHONE APPARATUS.

in Germany. [illegible] it will be seen that the [illegible] P M [illegible] arranged with the soft [illegible] which support the wire [illegible] diaphragm D is securely [illegible] pole pieces by means of the threaded [illegible] at the same time answering [illegible] A the upper [illegible] the screws so fastened by [illegible] the metal plate M that [illegible] proper direction will [illegible] cede from or approach the diaphragm D.

Fig. 11 shows [illegible] receiver, and Fig. 12 [illegible] pearance of the magnet [illegible] the central office annunciator drop, his wants are made known and—but not quite so fast; we will capture and interview the first current wave arriving at the annunciator drop H, and learn from it a few necessary facts. After leaving the generator armature of the telephone instrument A, the wave discovered that the magnet ringer coils offered some objections to its free passage, but barring a slight rounding off of its edges no serious damage was done. Continuing the journey over a comparatively smooth road, the line wire, the wave reached the point B. At this point scores of wires terminated on small spring clips.

While passing over a short piece of very small German silver wire to a spring clip directly op- phones alone on almost any kind of system produces but little if any cross talk at all, which is due, of course, to the extreme smallness of the current transmitted.

The annunciator, or rather the switchboard drop H, is wound in 24 layers with about 3 500 turns of No. 31 B. & S. gauge single silk covered copper wire to a resistance of 75 ohms. If a current of one fourth ampere be allowed to pass through the coil for more than five minutes in succession the insulation would become charred if not actually burnt. In a previous reference the fusible cut-out is described as allowing a maximum current of five amperes to flow. It would, therefore, be of little use as a protecting agent for a wire

coil, that will not safely carry over 150 mil-amperes of current.

A little device, however, placed at the point D serves to protect the switchboard drop H against the passage of a dangerous current. The heat coil, or, as it is more properly named, the sneak-current arrester, is composed of a few feet of very small German silver wire, wound and so placed in relation to a fusible piece of metal, that the passage through the wire of a given current for a certain length of time will generate a sufficiently high degree of heat for melting the fusible metal, which, when effected, completely severs the drop connection from the line wire. However, the cable C also must be protected against the probable damage a highly charged though open wire might produce; therefore at the instant that the fusible metal of the sneak-current arrester opens the circuit, a spring normally under tension forces a terminal of the charged wire into contact with a ground connection, this action by causing an increased flow of current through the cable wire fuses the wire W C, thus leaving the cable entirely free from dangerously charged wires.

The disributing board F is, as its name implies, an arrangement for enabling the proper distribution of wires. When a newly established telephone exchange commences to operate, it is more than likely that the respective numbers usually given each telephone subscriber have been selected by the exchange manager himself, therefore at the very beginning a distributing board might appear to be a needless expense. However, after a short while it is found that John Jones, telephone No. 25, desires to remove his instrument to another part of the city, and that it will be necessary to connect the No. 25 telephone through another line circuit; a change of the telephone's number would be out of the question; therefore the distributing board is a convenience, if not almost an absolute necessity, for exchanges having over, say, 500 line connections.

A subscriber at the telephone A while transmitting a call causes the drop H to release its shutter, which in turn closes a local circuit at J, which by means of the bell L informs the operator K that a call has been made. The operator K now inserts the plug M into the line-jack H. Placing to her ear the receiver O and pressing the button N, she speaks into the transmitter P, perhaps "Number, please?" receiving in response, "Give me A S'." The plug Q is inserted into the jack H', and on pressing the button R the calling current is transmitted by means of the generator S over the cable wire G' and over the line wire W S actuating the magneto ringers contained in the telephones A S', thereby giving the usual ring. If while waiting for an answer from A S', the subscriber A should step away from the telephone and therefore require a recalling signal, the operator merely depresses the button T, thus causing a signal to be made at the telephone A. After the conversation either A or A S', on giving their generator armatures a few turns, throw the clearing out drop U, the operator again depresses the button N, and on receiving no response to her inquiry as to whether the subscribers are through, she would remove the plugs Q and M from the jacks H and H', and thereby restore to a normal position that particular set of cords.

American Electric Fuse Company.

In June, 1895, C. E. Brown and F. W. Maxstadt conceived the idea that the telephone and other electrical business of the United States and foreign countries was advancing at such a rapid rate that it was drifting into a vast and gigantic manufacturing industry, and that in this new and wonderful field in telephone, telegraph and electrical specialties

F. W. Maxstadt

C. E. Brown

AMERICAN ELECTRIC FUSE COMPANY.

there was a splendid opportunity in the manufacture of telephone and telegraph fuse and fusible cut-outs, telephone and telegraph lightning arresters and joints for telephone and telegraph wires, forming a solid mass of copper at the joint. Since the beginning of the manufacture of these specialties the American Electric Fuse company has branched out in the manufacture of similar fuses and fuse links for electric light and power circuits, and Messrs. Brown and Maxstadt have just completed negotiations with the owner of one of the largest manufacturing blocks in the city of Chicago for a factory on the 1st of March.

The following sketch of the gentlemen who are responsible for the development of this enterprise cannot fail to be of interest:

Clarence E. Brown was born in the city of Chicago in August, 1855, and received his education in the Scammon High School, after which he embarked with his father and brothers in the printing business, his father being the proprietor of one of the first Chicago papers, called the Chicago Express, which was merged into the Chicago Evening Journal. This fact may explain one element of Mr. Brown's success, his belief in advertising and his ability to recognize and appreciate the value of advertising broadcast in reliable and honest journals. Mr. Brown is now giving his entire attention and time to the financial part of the American Electric Fuse company, of which he is secretary and treasurer. He possesses a genial disposition, and he takes great pride in announcing to his friends that the American Electric Fuse company owes no one a penny.

F. W. Maxstadt was born at Albany, N. Y., in August, 1858, and was compelled to seek a position at a very early age, to help support his younger sisters and brothers and thus relieve his widowed mother. He learned the trade of machinist, and came West. After traveling through the entire western portion of the United States, Mexico and Canada, and operating mining machinery and electrical devices throughout the western portion of the United States, he returned to Chicago to take charge as chief engineer of the Western Union Telegraph company's headquarters at Chicago. After completing and operating the Western Union dynamo power plant for the western system of the Western Union Telegraph company, he turned his attention to the invention of electrical specialties

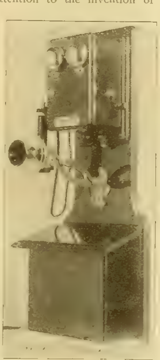


Fig. 1.

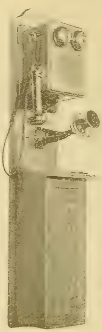


Fig. 2.

STANDARD TELEPHONE AND ELECTRIC COMPANY.

for the protection of telephone and telegraph circuits, until the demand increased to such an extent that he was compelled to give up his position as chief engineer for the Western Union Telegraph company, in order to do justice to the manufacturing of his electrical specialties. Mr. Maxstadt formed the corporation of the American Electric Fuse company, with Mr. Brown, in June, 1895, and since that time he has devoted his entire attention to inventing, designing and superintending the construction of the devices manufactured by the American Electric Fuse company, of which he is the president and general manager. Mr. Maxstadt is now giving his entire attention to new designs of fuse wire machinery for the manufacture of special fuse links and fuse wire.

Standard Telephone and Electric Company.

The history of the Standard Telephone and Electric company of Madison, Wis., explains the popularity of that concern in the independent field. Its product has been on the market since October, 1894, with a record of sales and satisfactory output to customers uniformly flattering from the first. In the state of Wisconsin alone the Standard company has equipped over 45 exchanges with complete apparatus.

The pioneer work of the Standard company was throughout the extreme Northwest, with headquarters at Minneapolis. Six months later the company was incorporated under the laws of the state of Wisconsin and thoroughly organized, with general offices at Madison. Among its promoters may be mentioned as one of its most efficient officers, E. W. Batchelder, its secretary, who has been actively interested in every move the company has made since its organization. Mr. Batchelder has been for nearly 30 years connected with telegraph and railroad affairs, and served for many years as operator, train-dispatcher and superintendent for the Chicago, Milwaukee and St. Paul and the Great Northern Railroad companies, engaging in telephone work in 1894 because of the inviting future presented in consequence of the expiration of the Bell company's monopoly. To Mr. Batchelder's efforts and close attention to the company's interest much of its success is due. His large acquaintance among a class of progressive men who knew his worth has led to the building up of a very substantial and reliable business in railroad and telegraph circles alone. His friends are legion, and his sterling qualities as a business man and personal friend are fully appreciated by those who are fortunate enough to know him.

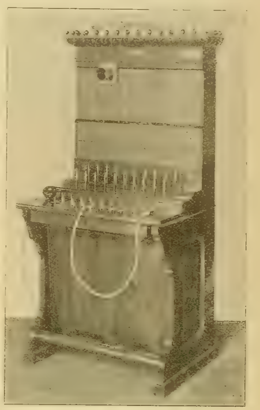


FIG 3. STANDARD TELEPHONE AND ELECTRIC COMPANY.

With the reorganization of the company and location at Madison, its financial and operative policy has been directed by its president, the Hon. P. L. Spooner, its treasurer, the Hon. H. A. Taylor, and a board of directors composed of men of affairs and of national prominence, whose interests have been largely located in Wisconsin for years.

Over two years ago the company found that it required to complete its personnel someone well acquainted in telephone circles—a man whose experience, ability and character would add to the company's standing and enable it to intelligently handle a rapidly growing business. J. J. Nate of Chicago was secured to co-operate with the officers of the company in its earlier work and later appointed general manager in full charge.

Recently the company has gotten out several new instruments. One of these is the Standard special No. 80 long-distance telephone, Fig. 1. It is symmetrical and has efficient adjustable arms. The Standard telephone set No. 13, Fig. 2, is designed to meet the ideas of those who want an arrangement by which batteries are placed one above the other in preference to the style of wide battery box in ordinary use. A new and improved double-pole receiver has been designed more particularly for long-distance service. A power generator, differing somewhat from the ordinary form in bearings for contacts, is another recent addition. One-fourth inch copper brushes are used bearing on two metal wheels having a diameter of an inch and a half. A switchboard of special construction, known as the Standard No. 99, is shown in Fig. 3. This board has a uniform height of 4½ feet over all, and is furnished with from 90 to 180 numbers inclusive, a 90-number section having a width of 27 inches, while the 180-number requires a total width of only 54 inches, from which it is evident that 180 numbers are all readily within the reach of one operator. The board is furnished in four sizes, of 90, 120, 150 and 180 numbers each, the width increasing from 27 inches up to 54 inches, according to capacity, and is fully equipped with operative apparatus of new and novel design. An entirely new switchboard is now practically ready for the market, combining the many features of novelty and merit claimed for self-restoring drop and ring-off combination switchboards.

The Indiana Rubber and Insulated Wire company of Jonesboro, Ind., is enjoying a very satisfactory business. Mr. A. F. Seiberling, the superintendent of the company, has just returned from the East, where he purchased a quantity of new cabling machinery, insulators and braiding machines. This new equipment will enable the company to increase its output about one-fourth. The general outlook for business is excellent.

Proposed Standard Diagrams of Electrical Apparatus.[1]

The time has arrived when the diagrammatic illustration of electrical apparatus should be reduced to an art. A uniform code should be established containing a diagram for each piece of apparatus, each diagram being at once simple and, so far as possible, suggestive of the particular piece of apparatus which it is designed to represent.

A decided improvement has been made in this direction during the last few years, yet at the present time the system is far from perfect. Its development has suffered through a lack of unity among the various makers of these diagrams.

The electrical divisions in the Patent Office have done more toward the development of this art than any other one agency. Often in a drawing accompanying an application for a patent, when a circle was used to represent a battery, and another circle exactly like it to represent a dynamo, and still another, differing in no respect, representing the ground, the drawing was necessarily confusing, and for the most part, self-explanatory, and, we think, need no comment. The representation of a dynamo or motor by a circle with two tangent lines showing the commutator and two brushes has long been in common use. This form of diagram may be used for any direct-current machine in drawings where the form of the winding of the machine is either well understood or is not essential in the system to be represented. Similarly, the figure below it may be considered the generic alternator. Where it is necessary to show particularly the kind of a machine, the field coils may be added, as shown in the next three figures, which are so simple that they cannot be misunderstood by one accustomed to read electrical diagrams. The diagrams of the tri-phase dynamos or motors are shown by the characteristic windings of their armatures only. Where there is room for a doubt as to whether one of these diagrams represents a motor or a dynamo, a letter M or G, as the case may be, will clearly distinguish them.

The diagram representing the motor-generator will, perhaps, be subject to adverse criticism. In its adoption, good perspective is undoubtedly sacrificed for ease in drawing, but who can say that the diagram is not suggestive of what it is intended to represent?

The differentiation of the diagrams for the primary battery and for the storage battery from each other and from the ordinary diagram for a condenser, has been the subject of a good deal of thought. The primary-battery diagram is the one in ordinary use. The storage-battery diagram differs from it by having the plates connected in multiple, as in practice, and by the drawing of a square around it. This diagram will hardly be taken as representing a condenser, for the reason that the lines representing the plates of the battery are made thicker than those connecting the plates to the battery terminals.

The reason for not representing the ordinary hand magneto-generator and the constantly driven generator by the same diagram is that a need actually exists for distinction between them. This is especially so in diagrams of telephone exchange systems, where it is often difficult to distinguish between the hand generators at the subscribers' stations and the power generators at the central office.

The electrical measuring instruments need no comment, we think, owing to their extreme simplicity and the unmistakable evidence which they bear to their identity.

In the matter of single and double-circuit breakers, many forms of diagrams were considered, each of which would probably have its advantages in certain places. This brings out well the fact that these diagrams must be taken merely as a guide, and not as a rigid code which must be absolutely followed. For instance, if it were essential that the circuit-breaker should have an operating coil in each of the line wires, then it must be left to the designer or illustrator to make his own diagram for illustrating the particular case in hand.

On the simple telephone diagrams but little comment is needed. It would be well if all would adopt the form of transmitter shown, from the fact that its construction is so extremely simple.

The listening and ringing key for telephone switchboards is a simple representation of one of these pieces of apparatus in common use. The remarks made concerning the cut-outs will apply with equal force to these.

Two diagrams for polarized bells have been

PROPOSED STANDARD DIAGRAMS OF ELECTRICAL APPARATUS.

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was followed with difficulty, if at all. In such cases it has not been infrequent for the Patent Office to suggest to the inventor or his attorney that he submit a new drawing using a certain adopted form or diagram to represent his battery and another to represent his dynamo, and so on. In this way, and with the well-directed efforts of a number of patent attorneys, a great improvement has been made. These diagrams are to further assist in this direction.

It is well to state that no attempt at originality has been made in their selection. All available sources of information have been drawn from, and it has been the aim of this committee to adopt the best, regardless of whether they had been in common use or not. In deciding upon the diagram for any particular piece of apparatus the question was considered from several standpoints. Simplicity always earned the greatest consideration when several diagrams of apparently equal simplicity were to be chosen from, that one was taken which seemed most suggestive of the actual piece of apparatus represented.

The sheets of drawings attached to this report are,

[1] Report of committee of the Chicago Electrical association February 14, 1898.

its adoption, good perspective is undoubtedly sacrificed for ease in drawing, but who can say that the diagram is not suggestive of what it is intended to represent?

shown. The one on the right-hand side is preferable where its meaning cannot be mistaken. The almost universal adoption of this form of diagram has led this committee to show it here, although unless one is familiar with polarized bells in telephone work it must be said that it is not at all suggestive. In cases where it is thought best to be extremely explicit, or where the immediate context of the diagram does not suggest the use of a polarized bell, the diagram on the left is to be preferred.

The diagram for a polarized relay is, we believe, given here for the first time. By changing the plus and minus signs from one side of the armature to the other, it may be indicated that the relay will close on a minus current and open on a plus current, or vice versa. This is a feature which will be found at times very convenient.

The distinction between the ordinary resistance and inductive resistance is both simple and suggestive, the presence of the core inside of the coil conveying to the mind the presence of a certain amount of self-induction.

The use of two parallel zigzag lines for induction coils or transformers lends itself readily to the distinction between the primary and secondary, between the step-up and step-down transformers, and,

moreover, its construction is of such a simple nature that it was chosen without hesitation by this committee from among dozens of other good diagrams for representing the same apparatus.

In the telegraph sounder the magnet coil has been represented in outline. In this connection it may be said that where it is not essential to know the nature of the winding or the direction of the convolutions, this same form of magnet might be adopted in any of the relays or annunciators used elsewhere in these diagrams.

The selection of a symbol for a ground which might be universally accepted is apparent. The custom of some artists of placing palm trees and grass, or the drawing of miniature landscapes surrounding their ground wire, may add somewhat to the artistic effect, but certainly nothing to the clearness of merit of their work.

In conclusion it may be said that it is believed that where any particular piece of apparatus is to be presented for which no specific diagram is here found, it will be an easy matter for the person desiring such diagram to make it from the elements here shown.

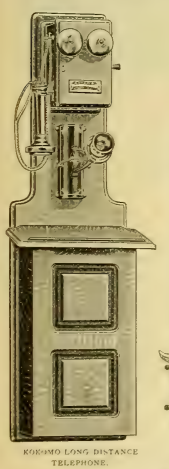
The effort of your committee has been to group acceptable conventional diagrams in a convenient form, and in carrying out the instructions of the Chicago Electrical association we bring to a focus a matter which has been under discussion for several years.

By the official adoption of these diagrams by a recognized body of electrical men, a standard of uniformity is presented to the public. The committee realizes that this list is not complete, but hopes that it will be a nucleus of a uniform symbolic language among electricians.

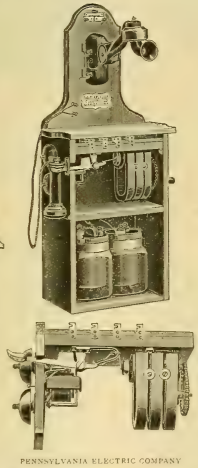
From time to time, as suggestions may be offered, suitable additions can easily be made to our present selections.

Kokomo Long-distance Telephone.

Of the telephone herewith illustrated the Kokomo Telephone and Electric Manufacturing company of Kokomo, Ind., speaks with positive assurance. This instrument is fitted with a Kokomo long-distance transmitter, four cells of battery, adjustable iron arm for transmitter, quarter-sawed white oak woodwork, and is equipped with an automatic lightning arrester. The transmitter used on this telephone was patented November 17, 1896. The telephone is in use on a government line in the West with great satisfaction. The Kokomo company claims that it has never failed and that it is the best long-distance telephone on the market.



KOKOMO LONG DISTANCE TELEPHONE.



PENNSYLVANIA ELECTRIC COMPANY

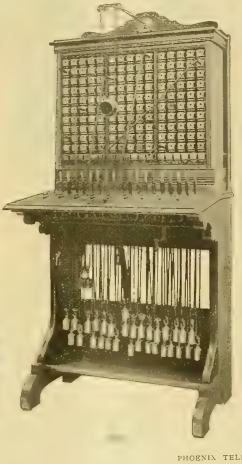
Pennsylvania Electric Company.

The Pennsylvania Electric company of Marietta occupies a large and well-equipped plant, including iron and brass foundries, machine and cabinet shops, testing room and dynamo plant with 110, 220 and 500-volt direct-current machines for testing and lighting purposes, coiling rooms and an especially fitted transmitter room. The buildings occupy a floor space of over 50,000 square feet on 10 acres of ground, in which there are ample side tracks of the Pennsylvania Railroad company. Lumber yard, coal, coke and iron bins, all of which are arranged with a view to convenience and economy in the operation of the plant. The apparatus is of high grade in material, workman ship and efficiency. The company is making a feature of its Crescent Ideal telephone, which is illustrated herewith. It will be seen that the movement of the magneto-bell is arranged in an entirely new and novel manner. The working parts are all mounted in such a way that they are easily detachable from the cabinet for purposes of inspection and repairs, and just as easily and quickly replaced. The electrical connection is made through large brass surface plates with machine screws instead of through binding-posts. The same type of instrument for series work is made in two styles, viz., the three-magnet, 10,000 ohms outfit, for exchange work or ordinary private-line and toll-line work, and the four-magnet, 30,000 ohms outfit, for toll-lines and severe long-distance series work. Bridging telephones are also put up in the same cabinet, which, with the improved transmitter material used by this company, are the inventions of Manager Bossart.

The transmitter is different not only in the material used, but the process of treating as well. The resistance in the primary circuit of the induction coil, through the transmitter movement, is reduced 50 per cent., and the sound volume and clear articulation are increased.

Phœnix Telephone Apparatus.

The Phœnix Electric Telephone company of 93 Washington street, New York, has recently made important improvements in its apparatus. The company occupies a five-story building and has a complete plant, including everything necessary for the accurate manufacture of each individual part. No factory in the United States can boast a more complete system. An accurate record is kept of each different operation during the process of manufacture, and each workman is individually responsible for every piece he handles. There are five departments, each under the supervision of a competent foreman skilled in his particular branch and all under the eye of a superintendent. Each workman receives so much raw material, with its accompanying card, which follows it through every operation and which, when it has finished its journey through the many different operations, must bear the inspection marks of each foreman through whose department it has passed, as well as the signature of the superintendent, before it passes into the storeroom to be again passed out to the assembling department.



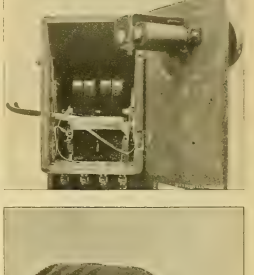
PHOENIX TELEPHONE APPARATUS.

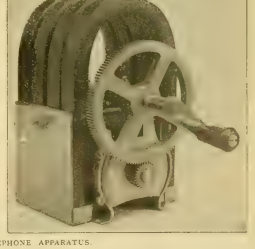
The new magnet generator recently put on the market by this company is made on the punch press, not a single casting being employed. This insures accuracy and make all parts interchangeable. The armature is laminated, being built up of 21 separate pieces, which prevents Foucault currents and gives a much greater efficiency. The large gear wheel has one-quarter inch face and is stamped from a solid piece of metal and is absolutely true and noiseless. The automatic cut-out is positive in its action. It has four bars of the best magnet steel. The cuts show the gears and automatic cut-out. The Sutton microphone has already earned for itself an enviable reputation. It will not lose its adjustment and never packs. The cut shows a cross-section of this microphone. The receivers manufactured by this company are of the standard pattern with powerful compound magnets of the best quality of magnet steel. The bobbins are silk wound and the core is nickel-plated to prevent rust interfering with the action of the diaphragm. In this company's long-distance exchange instrument (style No. 9) are embodied the up-to-date improvements in the art, as shown in cut. Should the transmitter be damaged, a set-screw removes it. Should the magneto be burned out, remove three wood screws and the entire magneto box comes off. Should the coil be damaged, a few screw turns and the entire arm and base come off. In fact any part of the telephone can be taken off without cutting a wire or removing the instrument from the wall.

The switchboards manufactured by this company are of the new self-restoring drop pattern. An illustration is presented of one of 150 drops. The magnets are double and are wound for the most exacting service. There are no operator's plugs, and the connection is made with but two movements, making it an exceptionally quick operating board. The case containing the magnets swings out on hinges and the table containing the operating keys also lifts up, thus making it very easy to get at all parts without disturbing any of the line wires. Every board is set up, carefully tested and operated before shipment. Switchboards and telephones are sold by this company, subject to approval.

Telephone Magnets.

The Varley Duplex Magnet company has for five years spared no expense in perfecting nearly every type of magnet, and especially is this true in the case of telephone magnets. Richard Varley, the president of the Varley company, has an interesting museum containing hundreds of types of telephone induction coils, no two coils being exactly alike. The gradual development of the induction coil for telephone and other purposes is here aptly illustrated. Some 50 odd types of telephone drop magnets and as many styles of series ringer magnets, wound with all sizes of wire, from 29 to 33 inclusive, are to be found in the collection.





Drop magnets show the most rapid advancement. The limiting dimensions of the spool being first determined upon to accommodate a given number of turns with a given size of wire, the magnet is handed over to the switchboard superintendent, who takes all sorts of privileges with the core iron to accommodate and support various fingers, triggers, springs, shutters and everything mechanical to make the switchboard work rapid. In regard to differentially wound coils, Mr. Varley claims that there is not so much call for this style of coil as there is abroad.

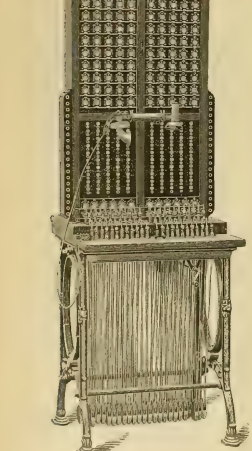
In the latest achievement in this line some marvels in magnet winding may be seen—magnets with one, two, three and as many as six wires, all wound on the spool automatically and simultaneously. In the case of a plain differentially wound coil the two halves are wound at the same time, and when the magnet is finished each wire has exactly the same turns and resistance, and, what is most desired, the insulation resistance between each

winding is so high that no deflection is obtained when testing for insulation resistance with a Thomson reflecting galvanometer having a constant of 45,000 megohms. This is due to the two windings being entirely separate, although occupying the same relative positions over a common core.

In the ordinary differential wound coil the insulation resistance varies inversely with the length of the two wires that are wound together; hence, in two similar sized differential coils of 50 and 500 ohms resistance wound with No. 30 and No. 35 wire respectively, the insulation resistance would be as 3 is to 1 in favor of the 50-ohm coil (two windings of 25 ohms each) and the actual insulation resistance would average anywhere from 20 to 50 megohms under favorable conditions, whereas in the double-compartment winding no difference exists between the insulation resistances of the two coils, the resistance being too high to measure by ordinary deflection method.

New Telephone Company.

The Ericsson Telephone company was organized a few days since in New York to succeed the firm of Smith & Patterson, who, for the last five years, have been importing Ericsson's Swedish telephones. These goods have been sold in all parts of the



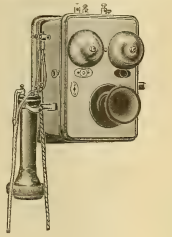
NEW TELEPHONE COMPANY.

United States and have been adopted by quite a few of the European governments. The generator is built on mechanical ideas and is the only one with an adjustment so that it can always be made to run true. The cut shows an operator's headgear, receiver and breastplate combined. The total weight is less than the ordinary headgear. One very important point is that the operator cannot get away from the transmitter, and is necessarily compelled to talk into it on all occasions, thereby rendering better service to the subscriber. The company will import all sizes of switchboard. It recently equipped an exchange with 10,000 drop switchboard. The Ericsson 1898 receiver has a powerful adjustable receiver, and requires no adjustment. The company has also brought out an improved [illegible] a main matter for long distance conversations, and guarantees perfect service on one cell only. At the same time, will guarantee that it will be used with 10 cells of the strongest battery known without injury. The domestic telephone equipped with the Ericsson imported transmitter will be manufactured in six different styles, each of the standard as well as the long distance [illegible] complete line of intercommunicating [illegible] has also been developed. The company will hereafter carry a complete stock of the imported goods in New York at all times, [illegible] other house promptness than heretofore. It will also be in position to deliver, from any of the distributing points, domestic or imported goods.

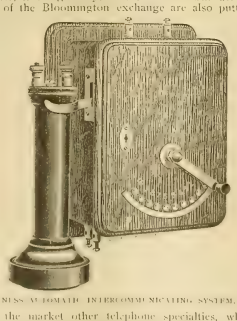
J. W. Thomson, Jr., & Co.'s Specialties.

Among the numerous independent telephone exchanges installed during the last three years the one at Bloomington, Ind., is a radical departure from common practice. The telephones in use were designed to abolish the gravity hook. There is no switch in the box. The connections run through from one binding-post to the other, soldered at the joints; there are no induction coils, no local circuit or local battery in the instruments. The battery is placed at the central station, and it has been found that the concentrated battery needs very little attention. At this time there are 262 telephones in actual use, and the current for the entire system is furnished by 144 Leclanché cells. These results are made possible by the use of the transmitter of J. W. Thomson, Jr. It is connected directly in the circuit, and the line is charged by the battery at "Central." One unlooked-for advantage that has developed from three years of experience of the Bloomington Telephone company in the use of this system is the total immunity from damage or burn outs by lightning or electric-light contacts. No damage has ever resulted from these causes, which fact is attributed to the high resistance of the transmitter, it being always in the circuit. The designers of the Bloomington exchange are also putting on the market other telephone specialties, which owe their merit to the Thomson transmitter. Prominent among these is the kitchen call box or one-way telephone. This little instrument consists of a transmitter, receiver, gravity hook and push-button, neatly assembled in a small box, without battery, induction coil or bell. From 10 to 20 of these little telephones can be placed on one wire and connected with one drop on the switchboard, as shown by the diagram. The idea is to place them in resident districts at a low rental. Such arrangement would afford telephone service to a new class of customers who are not subscribers for the regular telephones. Their introduction in exchanges is intended to increase the revenue by securing a class of subscribers that could not otherwise be obtained, and to make a demand by business and professional people for the regular telephone in order to secure the business coming from that class of subscribers. Another specialty is the interior telephone system, also with an isolated battery, which may be set up in any convenient place and connected to the battery wire of the system. No spring contacts switches are used. The wiring is simple, consisting of one circuit, soldered throughout. The only loose or removable connection in the instrument is a calling plug, attached to a cord, which may be left in any position after using until again needed.

NEW TELEPHONE COMPANY.—OPERATOR'S OUTFIT.



J. W. THOMSON, JR., & CO.'S SPECIALTIES.



NESS AUTOMATIC INTERCOMMUNICATING SYSTEM.

Ness Automatic Intercommunicating Switch.

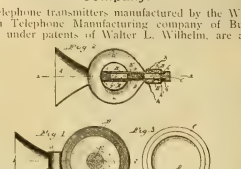
Among the labor-saving devices of the nineteenth century may well be placed the intercommunicating telephone. What a saving of time and how convenient it is to be able to call up instantly, without even the assistance of a central operator, any department in a large establishment!

WALTER L. WILHELM.

There are many forms of interior or intercommunicating telephones, but the great drawback to their universal use has been due in a large measure to the trouble experienced through the use of the manual switch employed to connect the various stations. It has been recognized that an automatic switch which would return to its normal point when a conversation was finished was absolutely necessary. The Ness automatic switch was consequently designed. The lever of this switch is simply turned around until it rests upon the switch point of instrument it is desired to call, a slight pressure upon it then rings up the person wanted, and when through talking the replacing of receiver upon the hook causes the switch to fly back to its own point, with no possibility of leaving the switch out of position for a call. This device, which is fully covered by broad patents, is manufactured by the Holtzer-Cabot Electric company of Brookline, Mass.

Wilhelm Telephone Manufacturing Company.

Telephone transmitters manufactured by the Wilhelm Telephone Manufacturing company of Buffalo, under patents of Walter L. Wilhelm, are attracting considerable attention, especially in Buffalo, Toronto, Philadelphia and Elmira, where they have been tested.



WILHELM TELEPHONE MANUFACTUOING COMPANY.

Mr. Wilhelm, the inventor of this system, is young in years, as his portrait, herewith presented, indicates, but he has had valuable experience and his inventions have attracted considerable attention.

The telephone transmitter which the Wilhelm company is now manufacturing belongs to that class of telephone microphones or transmitters which contain two separate diaphragms bearing against opposite sides of the same electrode and a single mouthpiece from which the sound is delivered by

two branch tubes against both diaphragms. The object of the invention is to produce a transmitter of this character which is extremely simple and inexpensive in construction and which can be easily assembled and adjusted. Referring to the accompanying diagram, A represents a mouthpiece, and a a two branch tubes or passages connected at their front ends with the rear end of the mouthpiece. B B represent two vertical supporting disks, secured to the open rear ends of the branch tubes and arranged parallel. The transmitting device is constructed as follows: C represents a rotary supporting ring provided on opposite sides with annular shoulders or seats c c, D D represent two diaphragms, which may be made of sheet carbon. E represents the electrode arranged between the diaphragms and bearing against the central portions of both diaphragms. The granular electrode is confined by a retaining ring F, which fills the space between the electrode and the supporting frame, and is composed of any suitable fibrous material which is sufficiently dense to prevent the powdered carbon from being displaced by creeping between the fibers, and which is sufficiently elastic or yielding to permit the diaphragms to vibrate freely for influencing the electrode. G represents packing-rings arranged between the supporting disks and the marginal portions of the diaphragms, whereby the latter are held in place. H H represent two contact springs which form the terminals of the conducting wires h h, and which are adapted to make connection with the carbon diaphragms when the transmitting device is in its operative position.

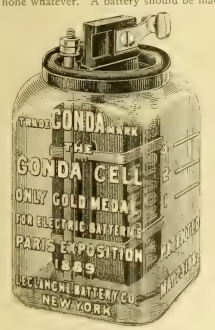
The vibrations produced by speaking into the mouthpiece are delivered by the branch tubes against the outer sides of both diaphragms, and the latter simultaneously compress the granular electrode from opposite sides, thereby increasing the force of the undulations in the current which transmits the speech to the receiving instrument in which the speech is reproduced.

A modified construction of the invention comprises a pair of transmitting devices similar to that shown in Figs. 1 and 2. A transmitting device similar in every respect to the one shown in Figs. 1 and 2 is utilized in this form also.

Mr. Wilhelm is at present engaged in developing a switchboard which has been said to be novel in design and valuable in the improvements introduced.

Leclanche Battery.

It is a mistake, say the makers of the Leclanché battery, to assume that a battery is a battery, and that the less one pays for it the more is saved. "When one takes into consideration," they go on to say, "the amount of pure cussedness which can lie hidden in a cell of poor battery, the trouble such a cell can make for its owner, the injury it can do to its surroundings and the loss which its behavior can entail, it becomes apparent that the entire cost of the cell is comparatively of little consequence, and the difference in price between it and a good cell of none whatever. A battery should be made of



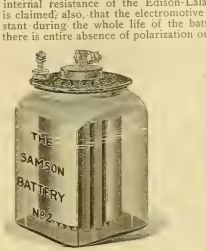
LECLANCHE BATTERY.

the purest materials by the most careful workmen and under the direction of accurate knowledge on the subject, or else it ought to be made at all. In other words, it should be the best possible, or nothing. For many years we have been trying to inculcate this axiom, and thousands have learned it never to forget it, but there are other thousands who still have it to learn and only be taught by object lessons at their own expense. Buying experience is expensive, and while it is not confined to battery purchases but is applicable to almost everything from a paper of pins to a locomotive, the practice seems to be a favorite method of wasting money with battery users. If we can save any such the cost and trouble of trying it for themselves we are glad to do so, and it is therefore not only with pleasure but with confidence that we speak of our battery, which has for more than a quarter of a century maintained its reputation in such a manner as to justify us in calling it, as we do, the standard open-circuit battery of the world. Our company is now in its twenty-seventh year of existence. The various battery cells made by us under the title of the Gonda trade-mark cells are known and used all over the civilized world, even in such remote places as China and Farther India. They were awarded the only gold medal given for batteries at the Paris exposition of 1878 and 1889 and the highest award and medal at the World's Columbian Exposition at Chicago in 1893. The Gonda trade-mark cells are so well known in this country and their reputation is so great that it is unnecessary for us to enter into a detailed description of them. We will be glad to furnish full information to anyone applying for descriptive catalogues."

The Gonda cells are made by the Leclanché Battery company of New York and are in widespread and long-continued use for telephone service. The cut shows the standard type.

Edison-Lalande Battery.

Stress is laid on the extremely low and constant internal resistance of the Edison-Lalande cell. It is claimed, also, that the electromotive force is constant during the whole life of the battery and that there is entire absence of polarization or local action.

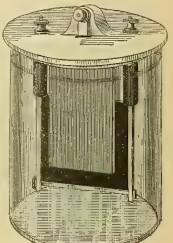


SAMSON BATTERY. Fig. 1.

The battery is light and compact and easily set up. The caustic potash for making the solution is sent out with the battery, doing away with all of the trouble and difficulty of securing pure sal ammoniac. When once the cell is set up it runs itself and very little inspection is necessary. There is, it is said, no creeping of salts, no corrosion of binding posts nor uneven eating away of the zinc, and when the cell is exhausted the operation of renewal is a very simple one.

The latest type of Edison-Lalande telephone cell (type X) is shown in Fig. 1. The cell is a square, vitrified porcelain jar, with a partition in the middle, and is made to fit into the battery box under the telephone transmitter.

The larger type of Edison-Lalande battery (type R, Fig. 2), has been used by a large number of telephone companies throughout the country with excellent results in connection with what is known as the common battery speaking-tube installation. In this system the transmitter and telephone are directly in series. No induction coil is used, the battery power for the transmitter being furnished by special wires which are run from one set of batteries to every instrument connected with the system. The New York and New Jersey Telephone company has

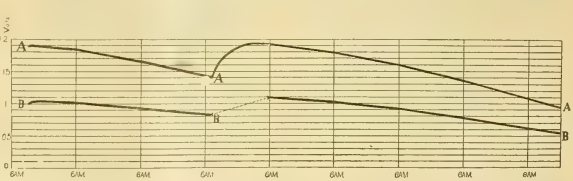


EDISON-LALANDE BATTERY. Fig. 2.

The battery must have the ability to stand at rest for long periods without wasting; at the same time it must be capable of furnishing a powerful current for the periods when the telephone is in use. The Partz acid gravity battery is said to meet these requirements. Each cell has a voltage of 1.8 to 1.9; two of them give from 3.6 to 3.8 volts, which affords an ample margin for telephone work.

The Partz, it is claimed, is to all intents and purposes an open-circuit battery; will stand for months without wasting, but when in use acts like a constant-current battery, and does not weaken or polarize until after long service. When it does weaken, the addition of a small quantity of the sulphochromic salt will bring up its efficiency almost to the original form.

The diagram here shown exemplifies the rejuvenation of a Partz cell in this manner, the point of which is that until the fluid becomes saturated the power of the cell can be again and again restored by the feeding in of the salt. The diagram is the record of a test extending over 186 hours, during which the circuit was kept closed continuously except for one interval of 22 hours, when four tablespoonfuls of the salt were put into the tube. AAA shows the electromotive force curve, which started at nearly two volts, dropped in three days to 1.4, rose again during the rest to two, and at the end of the test had dropped to one volt. BBB shows the concurrent changes in the current, starting at 1.00 milliamperes and ending with .55. Both electromotive force and current could have been rehabilitated by means of the salt.



PARTZ BATTERY.

In ordinary telephone work the Partz battery lasts a year or more without changing the fluid, and when recharging becomes necessary there is no handling of acid solutions. For long-distance telephoning it has especial advantages, and gives preeminent satisfaction on lines where the telephones are used frequently for long connections.

In a somewhat similar line of work, the ringing of fire-alarm bells, it has an enviable record. The Philadelphia Paid Fire Department has had two batteries, respectively of 50 and 62 Partz cells, in use on its alarm service since 1889, in which time the zincs have been renewed only twice.

Samson Battery.

Telephone transmitters require a battery with a low internal resistance on account of the low resistance of local circuit. Telephone users, therefore, are interested in obtaining a battery with the following characteristics: First, low internal resistance; second, high and uniform electromotive force; third, economical maintenance. That the Samson battery possesses all of these is demonstrated by these statements of the manufacturers:

First—The internal resistance is .13 of an ohm.

Second—The electromotive force is 1.40 to 1.47 volts, and this voltage diminishes very slowly on hard and continuous work. A feature is its ability to regain its full power after short-circuit of considerable duration.

Third—The economy of the Samson battery will become manifest to everyone who will consider its long life and capacity for extraordinary work. While the first cost is certainly greater than that of many battery cells now in the market, it will out-

one station at Morris Plains Insane Asylum equipped for 60 instruments, and the service from this plant has been extremely satisfactory. This battery is specially adapted to this kind of work on account of its low internal resistance, thus cutting down the trouble from cross-talk.

These batteries are manufactured by the Edison Manufacturing company, New York.

Partz Battery.

The exigencies of telephone service require a combination of qualities not possessed by ordinary forms of batteries. There must be a comparatively high voltage, in order that the voltage required for the service may be had with the fewest possible cells.

last four or five such cells, it is claimed, in addition to performing the work perfectly.

The Samson carbon is manufactured in France and is composed of two parts, a fluted lower portion and a threaded top carrying the binding-post, which are baked in one piece in the kiln. This feature is unlike any other carbon and is a necessary one to obtain the best results. The lower portion is a thin-walled, fluted, hollow cylinder, made from special materials and by a special process, resulting in a quality of battery carbon which, it is said, cannot be obtained in this country. While the crude carbon is remarkably pure, great care is taken to free it from all injurious elements, such as iron and other foreign substances, which would be liable to produce local action. The carbon mixture is subjected to a special patented process, which renders this portion, after baking, exceptionally porous. The top portion is composed of an entirely different kind of carbon from that used in the lower portion, and, after being subjected to enormous pressure, is treated when the carbon is complete in a way which renders it impervious to the creeping tendency of the solution and action of the ammonia gas.

The upper and lower portions, after being formed, are properly baked in the kiln, after which the top

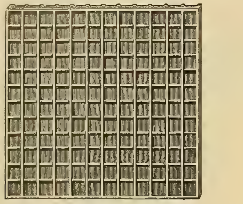


FIG. 1. HATCH STORAGE BATTERY.

of the carbon is heated redhot and plunged in hot paraffine, so that it enters into the minutest pore instead of simply collecting on the outside, as is the case with many battery carbons. The carbon made in this way has a hard, dense top and a very porous lower portion. The manufacturers state that no other carbon is made in this manner, and that it is impossible to obtain the greatest advantages when a carbon is molded in one piece.

A combination of manganese and pea carbon is placed inside the fluted portion and held in position by a specially prepared plug which will not fall out. It is this depolarizer and its close proximity to the exceptionally porous carbon which imparts to the battery its remarkable recuperative qualities. It can be easily renewed. After the depolarizer has been placed inside the carbon the connection, made of brass heavily tinned, is affixed. It is composed of large, heavy parts and includes a safety check nut.

The result of this thorough and necessarily expensive mode of manufacture is the production of a battery carbon which is claimed to have a larger surface, longer life and greater recuperative power than any other carbon element ever manufactured.

Prof. H. S. Carhart in "Primary Batteries" says: "The amount of energy held potentially in the cell is represented by the weight of the zinc." Also that the use of the small zinc rod indicates large internal resistance. The Samson zinc is of the circular form and is well amalgamated. An important improvement in the battery has been made and the elements are now joined to the top in such a manner that it is impossible to short-circuit the carbon and zinc. The carbon is held half an inch away from the bottom, and the zinc is a trifle shorter than the carbon, to avoid possible bridging of salts. The battery is "shipped set up" and having the package of sal ammoniac inside the jar. It is the first cell ever constructed embodying this desirable feature. The Samson is extensively used and carried in stock by leading supply dealers.

The Electric Gas Lighting company, Boston, Mass., is the agent in this country for the French manufacturer and will furnish pamphlets, prices and data upon application.

Gordon-Burnham Battery.

Superiority is claimed for the Gordon cell, for telephone work and other service, in that it cannot be polarized under the most severe closed circuit work until the very last ampere-hour of life is reached in the consumption of its elements, at which time it will, of course, show a diminishing electromotive force. Its commercially available electromotive force under closed conditions is claimed to be from .65 to .75 volt, although it has been known to hold this until an output of 375 ampere-hours, or 250 watt hours, has been taken from the elements contained in a 6 [illegible]. On the telephone test of .5 volt, above 500 ampere hours have been recorded. The volume of current possible is very large, and a discharge as heavy as two or three amperes on closed circuit is possible without pulling the electromotive force below a commercial point; in fact, it is said that as high as 12 amperes can be drawn.

For switchboard work the Gordon cell is especially recommended.

Compared with gravity cells the first cost of this battery is considerably higher, but it is, nevertheless, as is claimed, much cheaper in the long run, owing to longer life and higher efficiency. The Gordon-Burnham Battery company of New York, manufacturer of the Gordon cell, refers to well-authenticated tests in telephone service to prove this.

In the Gordon cell a perforated cylinder is suspended by a metal rod from a cover, and in this cylinder the black oxide of copper is placed; this copper is specially manufactured and consists of thin flakes and granules, thus offering to the excited fluid a great surface. The copper oxide as a depolarizing agent has an activity of over 15 to 1, as compared with the best gas-retort carbon found in the market at the present day. Three porcelain lugs or cleats are attached to the lower part of the cylinder, upon which rests a rolled zinc cylinder 5½ inches in diameter by 2½ inches wide, and weighing 1½ pounds, of chemically pure zinc amalgamated with mercury by a special process, which produces a practical alloy. The zinc conducts the current by means of a No. 12 copper wire riveted by copper rivet to the zinc, the connection and wire being insulated to prevent local action. The result is an internal resistance stated to be only from .04 to .06 ohm. The solution used is an alkaline one, technically termed electro-sodium, which is one of the most active electrolytes known; it is thoroughly reliable at a temperature of 25 to 30 degrees below zero Fahrenheit. The cells are manufactured in two sizes, the No. 1, or 6 by 8-inch jar, good for over 300 ampere-hours, and the No. 2, or 4½ by 6-inch jar, good for 100 ampere-hours. These results are guaranteed by the manufacturer.

Hatch Storage Battery.

The accompanying cuts illustrate the improved Hatch accumulator, made by the Hatch Storage Battery company of 53 State street, Boston. It is not claimed that the battery involves any new chemical or electrical principle, but stress is laid on the mechanical construction of the cell. Fig. 1 shows the face side of the plate, with square receptacles for the active material. This plate is of earthenware, porous and unglazed. After the plates are loaded with the lead oxide or active material, they are placed back to back, thus forming one couple. Grooves in the back of the plates admit a free circulation of the electrolyte. A series of the couples, when assembled, forms a complete element (Fig. 2). The sides of this element thus assembled are flanked with a rigid support plate of glass or similar material, and then encircled with heavy rubber bands. The

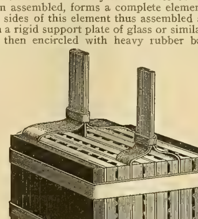


FIG. 2. HATCH STORAGE BATTERY.

electrodes are attached in any desired form, but ordinarily they are applied in the form of lead sheets, interleaved with the active material, as shown in Fig. 2.

This form of battery is of course much lighter than the "grid" type, and the cost of manufacture is claimed to be less.

The battery is recommended for central-station work and for traction, launch or carriage service. The company guarantees the maintenance of its accumulators for 10 per cent. per annum of the original cost when used for installations for large capacity, like central-station work or railway-carriage service, provided that in such cases the working of the plants is properly done and within reasonable limits.

As to the patent infringement question, Causten Browne, the eminent lawyer, has given his written opinion that the batteries described in the Hatch patents do not infringe the Brush patent.

Electrical Uses of Creosoted Wood.

The manufacture of conduits for underground wires is an important branch of electrical construction. A period of 14 years, electrically speaking, carries one back to ancient history, yet the creosoted wood conduits used in Brooklyn during that time are still in use and bid fair to remain there for a century or until electrical currents are carried without the use of wires.

Creosoted cross-arms are somewhat new on this side of the Atlantic, but the many years which the English government has used creosoted poles, cross-arms, etc, for its telegraph service have demonstrated the economy of creosoting. Creosoted arms cost more to begin with, but the total cost in the end is less, and there is less cost of maintenance and less interruption of service.

Probably the hardest competition which established electric-light and power companies have to meet is that from municipal plants. The installation of steam-heating plants to sell the exhaust steam will put electric-light companies in an advanced stage which the municipal "reformers" have not entered and make it impossible for municipal plants to produce lights as cheaply as a private company.

The Michigan Pipe company of Bay City, Mich., has supplied over 100 steam plants with steam-pipe casing, which makes the use of underground steam and hot-water pipes a commercial success. The creosoted wood conduits and other creosoted wood products are of interest to all electrical companies.

Wire for Telephone Work.

A recent visit to the factory of the Safety Insulated Wire and Cable company, Nos. 225-239 West Twenty-eighth street, New York, especially undertaken to ascertain the company's relation to the telephone industry of the United States, revealed a spacious and up-to-date insulating plant, busy in every department.

Apropos of this telephone issue of the Western Electrician, it is interesting to note that the first order received by the Safety company was dated January 29, 1888, calling for 50 miles of No. 18 B. & S. braided and twisted telephone wire for the Metropolitan (New York) Telephone company. From this initial order the Safety company has kept pace with the marvelous growth of the telephone industry, and at the present time it is said that there is not a telephone installation of any size in this country where Safety wire or cable has not been installed.

The following sizes are those principally in use by telephone companies: No. 20 B. & S., 3-32 insulation, plain, without braid, single and twisted in pairs; No. 20 B. & S., 3-32 insulation, braided, single and twisted in pairs. One conductor in the plain and braided twisted pair is colored so as to distinguish it from the other. This gauge is known as distributing-board wire. No. 19 B. & S., 3-32 insulation, plain, without braid, single and twisted in pairs, and No. 19 B. & S., 3-32 insulation, braided, single and twisted in pairs, are used for inside wire. The braided and twisted pairs of this gauge are produced in black, and in oak, cherry and mahogany, to match the woodwork in interior of buildings and residences, rendering the wire unobtrusive to the eye. A unique feature of the braided and twisted pair in this gauge is a raised marker thread running uniformly through the braid of one of the conductors, not perceptible to the eye, but of great utility to linemen, when working in dark places, and in connecting up the circuits. A workman running his finger along the twisted pair, can readily feel the raised thread on one of the conductors, thereby ascertaining what side of the circuit he is on. Such a demonstration renders testing out practically unnecessary. This feature is covered by a patent owned by the Safety company. No. 18 B. & S., 4-32 insulation, is used principally in aerial cables, which run from 1 to 51 pairs. These cables are served with jute, one layer of tape and a heavy braid, or two heavy reversed layers of tape over all.

For line purposes the Safety company makes a wire composed of No. 16 B. W. G. hard-drawn copper, braided, twisted in pairs, 5-32 and 6-32 insulation. This wire recently came into prominence by being used to connect the stranded steamship St. Paul with the New Jersey beach, and conversation was maintained throughout the five days' sleet storm (at a distance of 2,000 feet from the shore) with all points reached by the long-distance telephone. This wire has since been known as "St. Paul wire."

An important branch of the Safety company's business is its submarine department. This company is now about to lay a 5,000-foot, 10-pair telephone cable across the North River, for the New York Telephone company, and a smaller cable across from Bergen Point to Staten Island, for the New York and New Jersey Telephone company. There are over 20 such Safety cables now in use by these two telephone companies alone. The Safety company is now constructing 39 miles of submarine cable for the United States government, which is said to be the largest order for submarine cable ever placed in this country.

It must not be thought that the Safety company devotes all its output to telephone work. On the contrary, it claims to be the largest producer of rubber-covered and lead-encased underground cable for electric-light and street-railroad purposes in this country. The underground work of the Safety Insulated Wire and Cable company is represented in a large number of important contracts, and Safety underground cable has been contemporaneous with successful underground work from its early stages

down to the present day, in all the principal cities of America. Some of the company's large underground contracts are: One hundred miles of 1,000,000 circular mils rubber-covered lead-encased Safety cable for the Union Traction company of Philadelphia (this contract amounted to over $400,000); 200 miles of underground cable, Boston Electric Light company; 200 miles of underground cable, Manhattan Electric Light company, New York; 180 miles of underground cable, Mount Morris Electric Light company, New York; 500,000 feet of 211,600 up to 1,600,000 circular mils underground cable, North and West Chicago Street Railroad companies; 30 miles of underground cable, Buffalo General Electric company; 25 miles of underground cable and several submarine cables, Chicago City Railway company; 30 miles of underground cable, Public Lighting Commission, Detroit; 26 miles of underground cable, Police Department of New York.

The company has made a specialty of police and fire-alarm underground cable, and its product is exclusively in use by the Fire Department of Cincinnati, Police Department of Detroit, Police and Fire Departments of Newark, N. J., and the Police and Fire Departments of Portland, Maine. A large quantity of Safety underground cable is in use by the Fire Department of Chicago, Police Department of Boston and Boston Automatic Fire-alarm company, and orders for about $40,000 worth of Safety underground cable for the Fire Department of New York have just been received.

Safety wire and cable is used exclusively in the following new tall office buildings in New York: R. G. Dun building, Standard Oil building, St. Paul building, Syndicate building, Bowling Green building, Postal Telegraph building, Singer building and others.

It is interesting to know that in transmitting Niagara's power to Buffalo, Safety lead-encased underground cable was used exclusively wherever insulated wire and cable was required in this installation.

As an indication of the quality and durability of Safety lead-encased underground cable it may be mentioned that the Safety underground conductors used exclusively in lighting the World's Fair were subsequently used at the expositions in Atlanta, Ga., and Nashville, Tenn. Notwithstanding the drawing in and hauling out, handling and shipping incident to three distinct underground installations, this identical cable will again be put in service at the Trans-Mississippi exposition to be held at Omaha, Neb.

The enviable reputation of the Safety company and the undoubted prestige of its product have been brought about and made possible by the indefatigable efforts of its general manager, Mr. Leonard F. Requa. Mr. Requa's experience in the insulated wire and cable business dates back from the earliest stages of the art. He is a man with a large following of friends in the electrical business, and has a well-won reputation for securing large contracts for insulated wire and cable.

THE TELEPHONE TRADE.

In employing sal ammoniac for telephone use it is important that the product should be free from impurities. A. Klipstein & Co. of 122 Pearl street, New York, say of their well-known Electric brand of sal ammoniac that it is absolutely free from acid and metallic impurities, being almost chemically pure.

A concern well known to the telephone trade is the Electrose Manufacturing company, 127 North Tenth street, Brooklyn, N. Y. This company manufactures electrose telephone receiver cases, mouthpieces and other parts which have become staple articles with the trade and are now in general use, having stood the test of several years. The company also manufactures receiver caps, handles, push buttons and other electrical merchandise for the trade. All those in the market for goods of this kind will do well to get further particulars and prices from the Electrose company.

Close observers of electric woodwork cannot fail to be impressed by that turned out by the H. C. Underwood Manufacturing company of Wabash, Ind. This company manufactures all classes of special work as well as that used for telephone construction, storage batteries, etc. It does not aim to make work cheaper than anyone else, but the purchaser has the satisfaction of knowing and the quality is unequaled, always remaining in condition and showing strength and skill in construction as well as taste in design and finish. The best is the cheapest.

Mr. William Roche of 259 Greenwich street, New York, who has been for many years identified with the manufacture of dry batteries, has now a large factory at this address, although only established there for a few months. The growth of the business has been exceedingly rapid, and to such an extent that Mr. Roche has been compelled to add another floor, in the large building where he is located, to his present space in order to meet the large demand for his goods. The New Standard, which is especially made for telephone purposes, is having a large sale, while the No. 3, which is only 3¾ by 1¾ inches, not including connections, is one of the best kind of batteries that is manufactured of its class. It will fit inside of the Blake transmitter and is guaranteed by Mr. Roche to all purchasers. The fact that Mr. Roche has manufactured, during his connection with the electrical business, over 1,250,000 dry-battery cells, places him in a position to be relied upon in the production of a first-class dry battery.

The manufacture of wire properly insulated for telephone work has long been a feature in the establishment of Alfred F. Moore of Philadelphia. Having been established in 1820, this concern is now completing 78 years of practical experience in the production of insulated wire. It is one of the largest manufacturers of switchboard cords and cables, telephone cords, fine magnet wire for instruments and magnets, and wires and cables for interior telephones and intercommunicating systems. The desire for none but first-class product for use in in telephone work is now well recognized, and the years of experience which the establishment of Alfred F. Moore has had eminently fits it to guarantee purchasers none but the best material.

Charles Martin of Detroit, successor to the business of W. R. Cole, has entered the telephone field with every promise of success. He manufactured the 6,000-wire switchboard used by the Detroit Telephone company and has control of several valuable switchboard patents. His standard multiple board is capable of handling 5,000 lines of either metallic circuit or common return. He contemplates placing on the market a new 10,000-wire board that will be no larger than the 5,000-wire board, and in which it is not necessary to have two annunciators to each line, as is shown in some projected large boards. He also contemplates placing before the public a new switchboard, capable of handling 1,000 lines without the necessity of trunking or the use of the multiple board.

Edwin E. Marvin, clerk of the Circuit Court of the United States for the District of Connecticut, has given a certificate to show that, in so far as the records of the court show, the original interlocutory decree obtained by the National Conduit Manufacturing company against the Connecticut Pipe Manufacturing company on April 21, 1896, still stands in full force and effect. The decree enforced the opinion of Judge Townsend upholding the validity of the National company's patent No. 395,584. This patent was issued to Edward H. Phipps and afterward assigned to the National Conduit Manufacturing company. It is dated January 1, 1889, and relates to improvements in conduits for electric wires and cables. The Connecticut company was held to infringe this patent and a perpetual injunction was granted.

The telephone trade as well as other large purchasers of cedar poles will be interested to know that word has been received from the Kirby-Dennis company of Marinette, Wis., to the effect that it has just purchased from the Laclabell company, Laporte, Ind., 100,000 acres of cedar-pole land; also that the company has bought from the Munising company of Cleveland, O., 84,000 acres, and also from W. D. Walbridge of Washington, D. C., 5,000 acres. This land is all in Dalta, Alger and Schoolcraft counties, in the upper peninsula of Michigan. The Kirby-Dennis company further states that it has now in operation as many as 25 lumber camps devoted exclusively to its own business. It is needless to say that the company feels that with its present equipment for business it is in an extraordinarily good position to fill all orders for cedar ties, poles, piling and posts, on the shortest notice and with the greatest promptness. William A. Dennis of the company has recently visited Chicago, and it is said that the final negotiations for the purchase of the cedar land described were consummated during his visit. Mr. Dennis has been most energetic in pushing the affairs of his company, and it is said to be largely through his personal efforts that the Kirby-Dennis company is in its present condition.

The Connecticut Telephone and Electric company of Meriden, Conn., spent two years in perfecting a central-station switching apparatus, which is receiving a great deal of favorable comment from the telephone trade. The company now offers a switchboard for which its claims are exceedingly strong, as the drops and jacks are combined and are self contained and interchangeable, and can be immediately removed from the board in a fraction of a minute. In this system the company uses no clearing-out drops in switch levers or calling keys cut into the great circuits, but the call is answered, the shutter reset, the person wanted called and the necessary connections made in only two visible moves. It is needless to say that these points appeal particularly to the manager of exchange work, as it means reduction in cost of operation, quicker service, less operators and larger dividends to stockholders. These switchboards are manufactured from four to 1,000 drops, and are now in daily operation in prominent localities in this country. In the manufacture of telephones the company has 25 different styles which amply meet all the requirements of the average purchaser, and a full line of telephone supplies, and everything that is necessary to the telephone business. From a small beginning the Connecticut Telephone and Electric company has now grown to large proportions, and is recognized as one of the strongest companies in the telephone field.

It is understood on good authority that the Chicago Telephone company has just executed a lease with George H. Holt, owner of the Manhattan building on Dearborn street, Chicago, for 20 years, taking over 4,000 feet on the seventh floor, it being the intention of the Chicago Telephone company to locate its "Harrison" exchange in that building in order to better cover the surrounding congested district. The Chicago Telephone company, it is said, will spend $180,000 to locate the Harrison exchange in the Manhattan building, and it is also stated that the telephone company decided on the Manhattan building after examining a number of others; it was owing to its being so well lighted and ventilated and its strength of construction that the Manhattan building was chosen. As is well known, the Manhattan is a 16-story building and has the general offices of 18 great insurance companies, as well as the offices of the Hoosac Tunnel fast freight line, Nickel Plate fast freight line, etc. It is in almost what might be called the center of the electrical section of Chicago, being close to the Monadnock block, Old Colony building and Ellsworth building. Three hundred and twenty-one feet of its ground floor, too, has just been rented to the Safety Insulated Wire and Cable company for a western store and offices, and it is said also that the Sprague Electric company is figuring on taking two main stores on the ground floor. The management proposes to make the Manhattan building what might be called a high-class "electrical building."

De Veau & Co. of 27 Rose street, New York, are prominently known in the electrical field as being among the pioneers in the manufacture of telephones. Being established in 1892, with Mr. A. S. De Veau as general manager, their success has been continued from the start. Mr. De Veau has been connected with the manufacture of telephones and magneto bells for over 12 years, having been originally identified with the Western Electric company, in its telephone department; he was also an operator and inspector in the American Telephone company. This firm has been obliged from the first to continually extend its facilities to meet the growth of the business, and on February first De Veau & Co. moved into their present quarters, which gave them an opportunity to give the production that their orders called for. Their superintendent, Mr. J. Auth, began in the early days to work in the electrical and telephone business, having been identified with many of the large companies, and he has had an experience that has been of great advantage to De Veau & Co. De Veau & Co. at present employ over 50 hands and have a large trade with all the principal electrical contractors of the United States, and supply telephones to the United States government and all of the principal railroads of the country. Their telephones and magneto bells are well known and familiar to all of the purchasing agents in the country, and they have supplied several large telephone exchanges with their product. One fact of which they are justly proud is that they have never had a lawsuit, nor has a question occurred in regard to their telephone apparatus infringing upon that of any other manufacturer. Employing skilled workmen and high-class labor, they are at all times able to turn out a superior class of goods. The motto which is followed in this establishment, and which greets the eye upon entering the office, is "Satisfaction guaranteed in every particular." And it is to this rule that De Veau & Co. ascribe much of their present success.

Hammacher, Schlemmer & Co. of 209 Bowery, New York, who furnish telephone-box hardware, are pioneers in the business. The firm was established in 1848, and has been in the front rank continually since. They carry a large stock of staple and fancy cabinet hardware, brass trimmings of all kinds, butts, locks, latches, screws and nails in all varieties, bolts, rivets, coach or lag screws, besides glue, sandpaper and supplies of all kinds. They also carry a large stock of builders' hardware and supplies, and can furnish all the hardware required for factory buildings. For factory supplies they are headquarters, as they carry complete stocks of belting, pulleys, trucks, and smaller supplies of every character for shipping-room use. Two other departments complete their list. One of tools for all trades and one of piano material and supplies. The latter bears peculiar interest in this connection due to the fact that they carry a large stock of imported music wire. This wire is particularly valuable for electrical purposes on account of its great tensile strength and absolute uniformity, two points rarely obtainable outside of imported music wire. This line also includes a large assortment of felt and cloths in various qualities. The department of tools for all trades is, as its name implies, literally one of tools for all trades. First, for the carpenter every conceivable kind of tool he requires, beginning with the hammer and the saw and going down through all the grades of fine joinery and inside work, supplying tools for each successive step. Next the cabinetmaker, the woodturner, the electrician, the machinist, the steamfitter, the plumber, in fact none are left out of the long list—tools for all trades in earnest. It is not necessary to add that for telephone-box hardware this house stands ready to submit samples and prices worthy of consideration. They can furnish everything needed, and are also well prepared to figure on special work of every character along hardware lines, and offer the lowest prices possible for first-class goods. They have been established at 209 Bowery for nearly half a century and their precedence to-day is the reward of merit.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued February 15, 1898.

598,905. Apparatus for Electrically Measuring Temperatures. Hugh L. Callendar, Montreal, Canada. Application filed July 31, 1896. Patented in England December 21, 1891.

The apparatus combines a galvanometer and compensating field coils in the electrical circuit of a standard resistance. The wire of a pyrometer is adapted for use in connection with this circuit.

598,922. Automatic Cut-out for Electrical Converters. William J. Greene, Cedar Rapids, Iowa. Application filed January 13, 1896. Renewed May 21, 1897.

In a suitable supporting frame there are a pair of solenoids oppositely inclined to each other, means for alternately energizing the solenoids, a switch-arm adapted to close and break the primary and secondary circuits, with a curved armature attached to its free end and co-acting with the solenoids, a pair of solenoid switches and a connection between them adapted to throw one open when the other is closed, and a projection on the switch-arm adapted to engage the solenoid switches alternately when near the limit of its stroke.

598,926. Box or Case for Secondary Battery Electrodes. George W. Harris and Richard J. Holland, New York, N. Y. Application filed September 3, 1896. Renewed July 17, 1897.

The receptacle is formed of insulating material and provided interiorly on its opposite sides with ribs which are integral with the sides and between which ribs are grooves for the reception of the ends of the electrodes, so that the latter will be held separated from each other, the ribs running uninterruptedly to the height of the electrodes to be received between them, so that buckling of the electrodes will be prevented, and the grooves having a special lining of insulating material and terminating at their bottoms in shoulders.

598,937. Trolley. Charles H. Johnson, Elmhurst, Cal. Application filed October 24, 1896.

One claim describes the combination of an upright secured to the top of a car, a post fitted thereto so as to revolve, means for holding the post in one of two positions, a block pivoted to the top of the post, a trolley-arm having a slot therein embracing the block, springs arranged within the slot for maintaining a normal position of the pole, a spring for overbalancing the outer end of the pole and a trolley carried by the outer end.

598,942. Electric Arc Lamp. George R. Lean, Cleveland, Ohio. Application filed February 20, 1897.

Of 43 claims the first is given: The combination in an electric arc lamp constructed to operate with alternating electric currents of a starting coil, a feeding coil, the feeding coil included in series with the starting coil, an armature for each coil, said armature being normally so disposed relatively to the magnetic fields of the respective coils that the armature of the starting coil will be actuated in advance of the armature of the feeding coil, devices connecting said armatures and connections between one of said armatures and the carbons of the lamp.

598,943. Electric Arc Lamp. George R. Lean, Cleveland, Ohio. Application filed February 20, 1897.

In this lamp both carbons are fed simultaneously and the arc is inclosed. The inner globe is supported in such manner as to permit the globe to have sufficient play to compensate for irregularities of the carbons.

598,946. Direct-acting Oscillating Electric Motor. James H. Mason, Brooklyn, N. Y. Application filed March 24, 1897.

A direct-acting oscillating electric motor comprising field magnets having forwardly extended arms projecting at right angles to the axis of their coils, means for energizing the field magnets, an armature comprising a plurality of radially extending arms mounted to rock back and forth between the projecting arms of the field magnets, the arms being provided with coils, means for maintaining a constant current through the coils of the armature and means for changing the polarity of the field magnets.

598,947. Track Bond for Electric Railways. Frank T. Mather, Detroit, Mich. Application filed June 29, 1896. Renewed December 24, 1897.

A system of bonding having a continuous flexible conductor laid in a groove in the flange of the rail and extending the whole length of the track. At the rail-joints a loop depends through an opening in the flange formed by cutting through the groove at the ends of the rail sections.

598,948. Electric Battery for Medical Purposes. Carl W. Moessner, Philadelphia, Pa. Application filed June 2, 1896.

In a medical battery, the rheostat for controlling the electric currents composed of a series of alternately arranged metallic and composition members, the metallic members being each composed of a series of metallic strips and provided with contacts, and a movable switch adapted to be moved over the contacts.

598,972. Tip for Electric Conductors. Alden B. Blodgett, Lowell, Mass. Application filed December 22, 1896.

An electric conductor comprising a conducting core, a non-conducting covering and a conducting needle having a transverse hole arranged within the covering, a wire passed through the covering and hole and bent on the outside of the covering to retain the needle and wire in place and a shell surrounding the needle and the end of the covering.

598,991. Controller for Electric Motors. Ernst W. G. C. Hoffmann, Charlottenburg, Germany. Application filed December 29, 1897. Patented in Germany November [illegible], 1895; in Sweden April 14, 1896; in Switzerland April [illegible], 1896; in England April 17, 1896; in Norway April 18, 1896; in Belgium April [illegible], 1896; in France April 20, 1896; in [illegible] 1896; in Austria June 24, 1896, and in Denmark January [illegible], 1897.

The combination in a controller for electrical apparatus with a controller part having suitable contact parts connected therewith for effecting the necessary circuit changes, of a rheostat, a part controlling the resistance of the rheostat connected in circuit, and means for automatically cutting a predetermined amount of resistance into circuit when the movement of the part is effected.

599,002. Incandescent Lamp. John T. Lister, Cleveland, Ohio. Application filed October 14, 1896. Renewed January 17, 1898.

This is the language of the claim: In an incandescent lamp, the combination with the annularly recessed extremities of the shell, of a cylindrical-cap therefor adapted to fit interchangeably over either extremity, a pair of filament electrodes extending through each shell extremity, corresponding electrodes adapted to engage the pair of filament electrodes when the lamp is in place, and means for securing the cap upon the shell extremity consisting of a wire spring partially encircling the cap and provided with inwardly turned extremities which pass through the wall of the cap and enter the annular recess in the shell.

599,015. Electric Elevator. Harold Rowntree, Chicago, Ill. Application filed February 28, 1896.

The principal feature of this elevator is the use of an auxiliary motor as well as the main driving motor. By the joint action of the speed of the two motors means is obtained for controlling the main motor.

NO. 599,002.

599,019. Automatic Railway Gate. John F. Small, Chicago, Ill. Application filed January 12, 1895.

A railway gate comprising a gate-arm normally held in an upright position, a solenoid interposed in a normally open circuit, a core, a connection between the core and gate-arm, whereby as the circuit is closed and the solenoid energized the core will be attracted to lower the gate-arm, an electro-magnet interposed in an independent normally open circuit and provided with an armature normally adapted to engage the connection between the solenoid core and gate-arm and hold the latter in a lowered position until the magnet is excited and the armature attracted, when the parts will be released.

599,032. Electric Arc Lamp. Charles N. Black, New Haven, Conn. Application filed April 20, 1897.

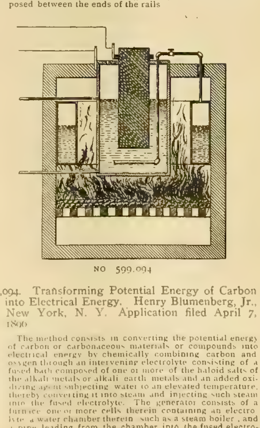
An armature is actuated by an electro-magnetic mechanism, and is pivoted to one side thereof; the free end of the armature carries the plunger of a dash-pot; the dash-pot is loosely supported from above in the line of movement of the plunger.

599,046. Electric Meter. Carl Raab, Kaiserslautern, Germany. Application filed February 27, 1896. Patented in England January 13, 1896, and in Germany May 30, 1896.

An electric meter having a disk armature and two coreless solenoids placed on opposite sides of the disk and in inductive proximity thereto, in combination with two electro magnets located also on opposite sides of the disk and having pole-pieces extending into close proximity thereto, the solenoids being located in the circuit to be measured and the electro-magnets in a shunt circuit thereto.

599,081. Insulated Joint for Railroad Rails. Thomas O'Brien, Jr., Philadelphia, Pa. Application filed June 4, 1897.

Features of this device are a cross-tie of non-conducting material, a metallic plate seated on the cross-tie having a recess formed in its upper face near an end thereof, an insulating block seated in the recess and substantially surrounded by the walls thereof and held thereby against accidental displacement, a rail having an end resting on the non-recessed end of the metallic plate, a rail having an end resting on the insulating block, and insulation interposed between the ends of the rails.



NO. 599,094.

599,094. Transforming Potential Energy of Carbon into Electrical Energy. Henry Blumenberg, Jr., New York, N. Y. Application filed April 7, 1896.

The method consists in converting the potential energy of carbon or carbonaceous materials or compounds into electrical energy by chemically combining carbon and oxygen through an intervening electrolyte consisting of a fused bath composed of one or more of the haloid salts of the alkali metals or alkali earth metals and an added oxidizing agent subjecting water to an elevated temperature, thereby converting it into steam and injecting such steam into the fused electrolyte. The generator consists of a furnace, one or more cells therein containing an electrolyte, a water chamber therein, such as a steam boiler, and a pipe leading from the chamber into the fused electrolyte.

599,121. Electric Gas-lighting Apparatus. William E. Cram and James H. L. Clegg, Boston, Mass. Application filed April 30, 1897.

A switch is operated by the movement of the gas-cock for making and breaking an electric circuit; an electro-magnet is arranged in this circuit and having a vibratile armature provided with a contact member arranged in proximity to the orifice of the gas-burner; a thermostat is arranged in the circuit and adapted to co-act with the vibratile member in causing a series of gas-igniting sparks, and to be expanded by the heat of the gas-flame, so as to separate the sparking points to break the electric circuit at the point of sparking, and to keep them separated during the existence of a flame.

599,162. Electric System of Propulsion. William M. Brown, Johnstown, Pa. Application filed May 18, 1897.

The combination, in an electric railway, of main feeders in sections, detachable connections between adjacent ends of the feeder-sections, groups of disconnected contacts corresponding in number to that of the feeder-sections, and sub-feeders connecting the individual members of each group with the connected ends of one pair of the feeder-sections.

599,186. Electric Controller. Frank A. Merrick, Auburndale, Mass. Application filed May 27, 1897.

A rotatable contact-carrying drum and a series of fixed fingers engaging therewith, in combination with an energizing coil for a magnetic arc-interrupter, connections from one side of the circuit through the energizing coil to one of the fixed fingers, this finger contacting with the drum at all of its operative positions, a direct connection from the same side of the main circuit to another of the fixed fingers, the last-mentioned finger contacting with the drum at only a part of its operative positions.

599,220. Electric Alarm Water Column. Martin L. Bush, Lawrence, Mass. Application filed June 14, 1897.

An alarm is electrically sounded when a float in a boiler water-gauge reaches a predetermined position.

599,274. Trolley Pole for Overhead Electric Railways. Joseph L. Walker, Louisville, Ky. Application filed June 18, 1897.

A three-jointed pole having its members pivoted together and provided with a trolley-wheel at its outer member, combined with a latch which holds two of the members in alignment, and trip devices operatively connected to the wheel-carrying pole member and the latch, whereby the latch is released when the trolley-wheel slips off the conductor and the pole is permitted to collapse.

599,292. Underground Conduit for Electric Wires. Adelbert L. Daniels, North East, Pa. Application filed December 22, 1897.

The conduit consists of sections having a metal case, with ends of insulating material of less internal diameter than the case, the ends of adjacent sections conformed to fit together, and a lining of insulating material connecting the ends.

599,302. Direct-current Meter. Gustave A. Scheeffer, Peoria, Ill. Application filed May 7, 1896. Patented in Canada December 2, 1896.

The first claim reads: In an electric meter, the combination with field coils connected with the circuit to be measured, of an armature adapted to be actuated thereby which is connected with said circuit and with the field coils to receive current passing through said coils sufficient to supply a torque thereto adapted to overcome the initial friction of the rotating parts.

599,304. Demagnetizing Device. Harry A. Storrs, Burlington, Vt. Application filed June 18, 1897.

The essential electro magnet has overhanging poles, and is adapted to produce an alternating magnetic field; a rotatable carrier for the object to be demagnetized having a fixed axis and adopted to move the object slowly between the poles of the magnet is provided, and a shield is interposed between the lower pole of the magnet and the object to prevent contact of the latter with the pole.

599,305. Electric Arc Lamp. Christian Tepel, Bennett, Pa. Application filed March 10, 1897.

The mechanism includes a pulley, suitable connections between the same and the carbon-holders for producing opposite movements of the latter by the turning of the pulley, a clutch-wheel fast with the pulley, a lever pivoted concentric with the clutch-wheel, a dog pivoted to one end of the lever and arranged to engage the periphery of the clutch-wheel, an abutment for the dog to encounter under one direction of movement of the lever to free the dog from its wheel, an air-cushion on the same arm of the lever, an electro-magnet in the lamp-circuit and a core in the magnet connected with the opposite side of the lever.

599,306. Making Filaments for Electric Lighting. Detlef C. Voss, Boston, Mass. Application filed August 3, 1891.

A filament for electric lighting built up and composed from aluminum and iodine; also the process of building up a filament by exposing the same in a vessel or flask containing the vapor of the alcoholic solution of iodide of aluminum while an electric current is passed through the filament.

599,307. Trolley-actuated Switch-operating Device for Electric Railways. Louis E. Walkins, Springfield, Mass. Application filed August 18, 1897.

In a "third-rail" electric railway system, the combination with the third-rail sections and the dividing length of insulating material having the recess of an electric switch, a depression member located in the recess and having its upper edge normally above the top of the tread-surface of the insulating material and provided with a supporting spring, and in moving serving to operate the switch, and provided with a depending ratcheted member, an electro-magnet having an armature normally in position for engagement with the ratcheted member, and adapted when the magnet is vitalized to withdraw the armature from its position of engagement.

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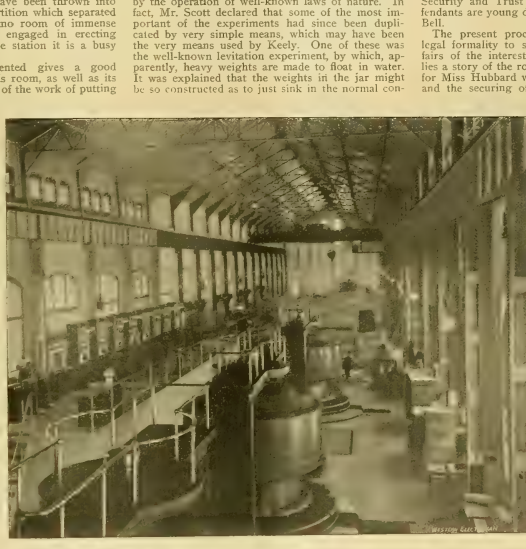
Enlarged Power House at Niagara Falls.

During the several conventions of electrical men at Niagara Falls last summer much interest was shown in the work of extending the power plant of the Niagara Falls Power company. At that time the new building was in course of construction and the wheel-pit was being extended. The old building was, of course, separated from the new part by a wall, and the delegates and visitors who inspected the work were compelled to rely upon their imaginations for a picture of the dynamo room when the new part would be completed and the partition removed.

The work has now reached a point where the entire building is enclosed, and the new and old portions of the dynamo room have been thrown into one by the removal of the partition which separated them. This makes the dynamo room of immense size, and as many men are engaged in erecting the additional dynamos in the station it is a busy place.

The picture herewith presented gives a good idea of the present size of this room, as well as its condition during the progress of the work of putting in the new machines, and will certainly prove of interest to all who have visited and inspected the original plant. The floor is, of course, littered with boxes and packages containing the various parts, while far in the distance may be seen the 50-ton electric traveling crane used to place the heavy parts of the installation in place. By the girder to the left may be gained a good idea of the length of the new and old sections, the dark part representing the new, and the light the old. Generator No. 4 and its connected turbine will soon be ready for operation. Other generators have arrived at the Falls from Pittsburg and will be placed in position without delay. When the 10 great 5,000 horse power generators are in line the sight in the power house will be most imposing. Down in the pit the bulkheads between the old and new parts have been taken out and the two sections have been thrown into one. Men are now busy installing the turbines, adding much to the activity about the station.



ENLARGED POWER HOUSE AT NIAGARA FALLS—VIEW OF DYNAMO ROOM, 426 FEET LONG.

As extended the power house provides for 10 generators, while the extended wheel-pit has room for the same number of turbines. There are now three generators and turbines in place, and, as already mentioned, the fourth will soon be ready for service. It is the intention of the company to have five of the seven additional turbines and generators installed by the Westinghouse Electric and Manufacturing company is supplying the generators, and the I. P. Morris company of Philadelphia the turbines. These concerns made the turbines and generators of the original installation now in use. The new turbines and generators will be of the same capacity as those installed. The new section of the pit is bricked to a height of about 40 feet with a 30-inch wall, 1,800,000 brick being used. The length of the original section of the power house is 150 feet, while that of the addition is 286 feet, making a total length of 426 feet. This, it will be readily understood, comprises the largest dynamo room in the world.

The details of construction of the wheel-pit have already been given in this journal, and the plans for the extension of the power house, including several changes in arrangement, construction of apparatus and operation, have been fully explained.

It is said that a company will be chartered, with a capital stock of $5,000, to construct and operate a telephone line between Princeton and Athens, W. Va. R. G. Meador, F. Holroyd and W. J. Lilly of Athens and William M. Maxwood of Princeton are mentioned as incorporators.

The Peculiar Mr. Keely and His Motor.

Eben A. Scott read a paper on the Keely motor before the Engineers' Club of Philadelphia not long ago. He described four visits which he had paid to the laboratory of Mr. Keely to inspect the apparatus in the interest of one of the largest stockholders in the motor company. In substance, it was stated that both he and Addison B. Burk, president of the Spring Garden Institute, who accompanied him on some of his visits, had reached the conclusion that Keely had discovered no new force, and had shown no apparatus which demonstrated or could demonstrate such a force, but that many of the things done by Keely could be readily performed by the operation of well-known laws of nature. In fact, Mr. Scott declared that some of the most important of the experiments had since been duplicated by very simple means, which may have been the very means used by Keely. One of these was the well-known levitation experiment, by which, apparently, heavy weights are made to float in water. It was explained that the weights in the jar might be so constructed as to just sink in the normal condition of the jar, and to rise when a slight increase of air pressure was put upon the surface through a fine tube carrying compressed air. Over the principle of the "Cartesian diver." This tube, called a platinum wire by Keely, was said to form an essential part of most of his apparatus.

The reading of the paper was followed by a discussion in which Mr. Collier, who said he had been connected with the company for 23 years, denied that the wire was a tube, and claimed that Keely would yet be shown to be the greatest discoverer of the age. He stated that some years ago Prof. Rowland of Johns Hopkins University had also said it was a tube, and asked Keely to cut it, but that Keely refused, as he was a peculiar man, and would not turn his hand over to prove a point to an inquirer, although besought to do so by his friends. He offered to give a lecture to the club on Keely's inventions, and when asked by a member whether he would bring Keely with him with the jar in question and make the demonstration before the club, he said that Keely had repeatedly refused to do anything of the kind. Mr. Collier was asked whether he knew the real facts in regard to Keely's discovery, and whether in case of Keely's death, he could carry on Keely's work. And if so, whether he would then come before the engineers and explain its merits fully. To this Mr. Collier replied that he knew all that Keely had chosen to, and that in the event of Keely's death he would be willing to give the desired explanation.

Prof. Bell's Romance.

An interesting story comes from Washington as an outcome of the suit instituted on February 25th by Prof. Alexander Graham Bell and his wife, Mrs. Mabel G. Bell, against Mrs. Gertrude M. Hubbard. Charles J. Bell, Elsie May Bell and Marion Hubbard Bell for the recovery of $59,798 and the appointment of the American Security and Trust company as trustee for Mrs. Bell to secure her interest in a trust fund, held for her by her father, the late Gardiner G. Hubbard. All the parties to the suit are related. Prof. Bell is the inventor of the telephone. Mrs. G. M. Hubbard is his mother-in-law and C. J. Bell is his brother-in-law and president of the American Security and Trust company. The other two defendants are young daughters of Mr. and Mrs. A. G. Bell.

The present proceedings appear to be a mere legal formality to secure an adjustment of the affairs of the interested parties, but behind the suit lies a story of the romantic attachment of Prof. Bell for Miss Hubbard which resulted in their marriage and the securing of the financial aid from Prof. Hubbard for the then newly invented telephone. Many years ago Mr. Bell was engaged at Washington as a teacher of the deaf and dumb, employing his leisure time in experiments with the idea of transmitting the human voice over a wire. During this period Mr. Bell became acquainted with Miss Hubbard, who was one of his pupils, and the two were thus thrown into contact frequently. They fell in love, and Mr. Bell proposed marriage.

In order to protect the interests of Miss Hubbard, who, as daughter of a rich man, had considerably better prospects than the young professor, a contract was entered into by Mr. Hubbard and Mr. Bell. The terms of this contract, as set forth in the bill filed last week, provided for the creation of a trust. Mr. Bell conveyed all his interests in his patents on the telephone, both at home and abroad, to Mr. Hubbard, to hold in trust for Mrs. Bell. Mr. Hubbard was to pay the income from these patents to Mrs. Bell as long as the income did not exceed $3,000 a year. When the revenue exceeded this figure it was provided that the excess should remain in Mr. Hubbard's hands until it reached the amount of $200,000. After this it was to be held as a trust fund, and all the income from the patents and the interest on the $200,000 was to be paid to Mrs. Bell. The trust was to continue until the death of Mrs. Bell, and the fund was then to go to her children, or, if she had none, to Mr. Bell.

This contract was executed on July 9, 1877, and Mr. Bell and Miss Hubbard were married. The bill recites that Mr. Hubbard faithfully performed his part of the contract until his death in the latter part of 1897. He left a will in which he devised his entire estate to Mrs. Hubbard, his widow, without any qualifications, and in fee simple. Mrs. Hubbard and Mr. C. J. Bell were named as executors without bond. It was discovered after Mr. Hubbard's death that the trust fund amounted to $259,798, and a list of the real estate and stocks held by Mr. Hubbard for the trust is filed. Mrs. A. G. Bell, therefore, under the terms of the trust, believes herself to be entitled to $59,798 at once, and asks that the American Security and Trust company be substituted for the executors of the will of Mr. Hubbard, so far as concerns the trust. The value of the estate left by Mr. Hubbard is given at $475,000 in stocks and real estate, $50,000 in furniture, and $59,000 due on notes.

W. R. Proctor, Breck B. Smith and Charles R. Powell have incorporated a company to construct a telephone system at Versailles, Ky.

Proposed Trolley Extensions on the Chicago City Railway System.

Ordinances have been introduced in the Chicago City Council providing for the extension of the present trolley system of the Chicago City Railway company as follows:

Indiana avenue, from Fifty-first to Sixty-third street.

Indiana avenue, from Eighteenth street to Twelfth street.

Fifty-sixth street, from State street to South Park avenue.

Fifty-sixth street, from Stony Island avenue to Lake avenue.

Twelfth street, from Indiana avenue to State street.

Vincennes avenue, from Thirty-fifth street to Forty-third street.

St. Lawrence avenue, from Forty-third street to Fifty-first street.

Lake avenue, from Forty-seventh street to Fifty-seventh street.

Fifty-first street, from west line of South Park avenue in Fifty-first street, east thereof to Cottage Grove avenue.

Fifty-second street, from Cottage Grove avenue to Lake avenue.

Center avenue, from Sixty-third street to Sixty-ninth street.

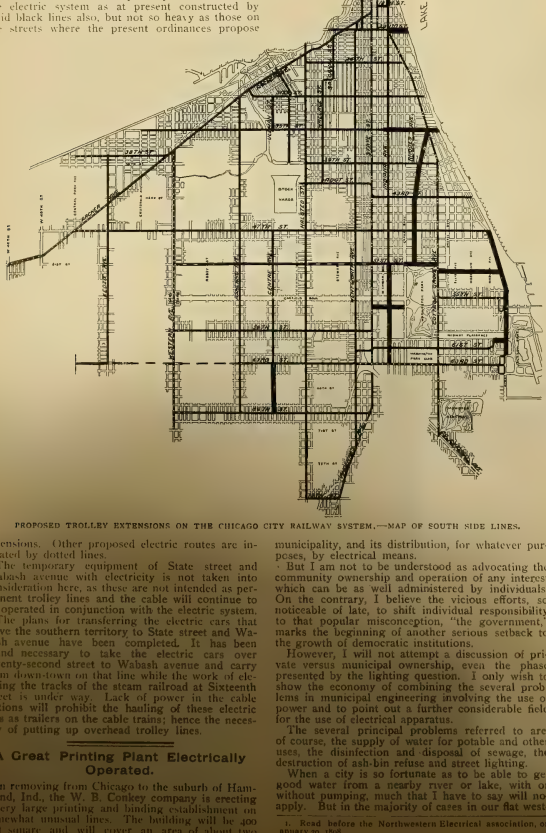
Stony Island avenue, from Fifty-sixth street to Sixty-second street.

Sixtieth street, from South Park court to Stony Island avenue.

Sixty-ninth street, from Vincennes avenue to Anthony avenue.

Keefe avenue, from Anthony to Chicago avenue.

In the accompanying map the proposed trolley extensions are indicated by heavy black lines, and the electric system as at present constructed by solid black lines also, but not so heavy as those on the streets where the present ordinances propose extensions. Other proposed electric routes are indicated by dotted lines.



PROPOSED TROLLEY EXTENSIONS ON THE CHICAGO CITY RAILWAY SYSTEM.—MAP OF SOUTH SIDE LINES.

The temporary equipment of State street and Wabash avenue with electricity is not taken into consideration here, as these are not intended as permanent trolley lines and the cable will continue to be operated in conjunction with the electric system.

The plans for transferring the electric cars that serve the southern territory to State street and Wabash avenue have been completed. It has been found necessary to take the electric cars over Twenty-second street to Wabash avenue and carry them down-town on that line while the work of elevating the tracks of the steam railroad at Sixteenth street is under way. Lack of power in the cable stations will prohibit the hauling of these electric cars as trailers on the cable trains; hence the necessity of putting up overhead trolley lines.

A Great Printing Plant Electrically Operated.

In removing from Chicago to the suburb of Hammond, Ind., the W. B. Conkey company is erecting a very large printing and binding establishment on somewhat unusual lines. The building will be 400 feet square and will cover an area of about two acres. It will be only one story high, and with especially arranged skylights the whole interior of the large building will be literally "as light as day." All the machinery in the plant will be electrically driven, and some 55 motors will be required, ranging from 10 horse power downward. About 42 of the large printing presses will be direct-connected to motors, and the smaller machines will be arranged in groups, with one motor for each. The power and heating plant will be housed in a separate building. It will include one 150 horse power, 220-volt, direct-current generator at the start, although it is planned that another unit of the same size shall ultimately be added. The lights and motors will be wired on the same circuits, and 220-volt lamps will be used. B. J. Arnold is the electrical engineer.

Electricity in Municipal Engineering.[1]

By Prof. R. B. Owens.

My object in presenting this paper is to emphasize the economy which can often be effected by generating at one point all the power required by a municipality, and its distribution, for whatever purposes, by electrical means.

But I am not to be understood as advocating the community ownership and operation of any interest which can be as well administered by individuals. On the contrary, I believe the vicious efforts, so noticeable of late, to shift individual responsibility to that popular misconception, "the government," marks the beginning of another serious setback to the growth of democratic institutions.

However, I will not attempt a discussion of private versus municipal ownership, even the phase presented by the lighting question. I only wish to show the economy of combining the several problems in municipal engineering involving the use of power and to point out a further considerable field for the use of electrical apparatus.

The several principal problems referred to are, of course, the supply of water for potable and other uses, the disinfection and disposal of sewage, the destruction of ash-bin refuse and street lighting.

When a city is so fortunate as to be able to get good water from a nearby river or lake, with or without pumping, much that I have to say will not apply. But in the majority of cases in our flat western country water is only obtainable from wells, driven or dug, and when a considerable amount is required, as for city use, it is generally necessary to separate the wells as far as practicable, because of the limit to the supply which can be continuously obtained per unit of volume of water-bearing strata.

In small towns of a few thousand inhabitants, where the underflow is good, it is usual to find driven wells 10 to 20 feet apart and a direct-acting steam pump over each, an arrangement which, as a rule, requires the construction of a railway siding for rapid coal supply. In cases of this kind I have recommended power pumps driven through a countershaft by an engine of economical design. To the same countershaft one or more dynamos can of course be attached. Now if both dynamos and pumps are driven by clutch pulleys, it is possible by shutting down pumps as dynamos are started, and varying the number in operation as lighting load varies, to keep an almost exactly constant load on the engine—the most favorable condition for its economical operation.

In larger towns, of from fifty to sixty thousand inhabitants and upwards, it is not unusual to find half a dozen pumping stations from one-half to one mile apart, each with a full complement of boilers, steam pumps and attendants, and the whole operated apparently as much in the interest of the coal dealers and those on the pay-roll as for the taxpayers. A one or two-cylinder pump without flywheel, lifting from a single dug well and discharging directly into the mains, is usual.

In a case of this kind recently coming to my notice, I urged the immediate substitution for the steam pumps of an equal number of triplex power pumps operated by constant-torque, variable-speed motors, the current for such motors to come from a central power plant equipped with economical chinery and suitably located.

The annual saving as the result of such a change was estimated to be more than 50 per cent. of total cost of operation. It might be remarked here that the recent appearance of satisfactory constant-torque motors, in both alternating-current and direct-current types for operation from constant potential circuits, removes the last difficulty in the most general application of electric power, and now it can be confidently hoped that non-expansive steam working, as in boiler-feed pumps, drain pumps, etc., in our lighting and power plants and also in many cases of pumping from wells against a constant head for city and other supply, will soon become a thing of the past.

The demand for water not being constant during the day, a suitable reservoir should always be supplied of such a capacity as not only to allow the engine or engines to operate at constant load, but also to supply the extra water for fire purposes whenever it is required. Such a reservoir, though indicated by economy, is often lacking, in whole or in part, and more unfortunate still is the too small size of mains usually employed, the latter necessitating in some cases that the pressure at the pumping stations be more than doubled during a fire to obtain normal or approximately normal pressure at points where fire engines are attached.

These faults, however, the absence of suitable storage capacity and too small pipe, belong to the original design, and have nothing to do with the kind of power used for the pumps. But their absence will, of course, be seen to greatly facilitate the economical operation of a combined plant—one intended for the utilization of ash-bin refuse, the supply of power for pumping, for disinfecting of sewage and for street lighting.

The usual method of handling sewage is by means of a water-carriage system—draining into the nearest stream without disinfecting. But this practice is barbarous. No system of sewage is complete which does not abstract the solid matter and sterilize the liquid portion before turning it into our waterways.

The solid matter is readily precipitated as "sludge" in settling pools, and the clear effluent subsequently treated or not, as the case may be. The sludge can be dried and pressed to about one part by weight of water and one part by weight of solids. This pressed sludge amounts to from one to two hundred weight per annum per head of population, according to recent statistics. At first it was thought to have a high fertilizing value, but I believe it is generally recognized now as being useless for such purpose.

It has, however, more than sufficient calorific value to evaporate the water it contains and to destroy itself, and so may profitably be mixed with ash-bin refuse and used for fuel.

Chemical methods of sewage disinfection, when effective, are expensive, and it would seem that electrical methods must supersede them in the future. The two principal methods of manufacturing a disinfecting fluid by electricity are Hermite's and Woolf's, the former being used principally on the Continent and the latter in this country. They do not differ much except in detail. In both systems the disinfectant is obtained by passing a large current of electricity at low pressure through sea or salt water, prior to or after being mixed with the sewage. From this results the formation of certain hypochlorites, hypobromites and iodine compounds—the latter are for the most part in the form of iodates—all strong oxidizing agents, directly or indirectly.

Where a common drainage and sewage system is adopted, the disinfecting liquid may be greatly di-

1. Read before the Northwestern Electrical association, on January 20, 1898.

luted during a storm, but the trouble is obviated by the adoption of separate systems, or by the use of a reservoir holding a considerable quantity of the liquid to be discharged into the sewage system in times of heavy rains.

One installation of the Woolf system reported consists of a 15 horse power engine with suitable dynamo, tanks, etc. A bacteriological examination made by competent persons showed almost perfect sterilization. This plant is considered sufficient for disinfecting the sewage of 30,000 population, if run continuously. At usual rates for fuel and attendance, the cost per inhabitant per annum was shown to be about 25 cents. A similar cost per inhabitant has been obtained elsewhere.

It will be seen, however, that this figure can be reduced to a small fraction of itself if the system were operated as a part of a combined plant instead of as a small separate one. As compared with other systems of sewage purification, chemical, land filtration, or a combination of chemical and land systems, the cost per inhabitant per year by the electrical system, even when current is supplied from a special plant, is apparently less by from one-half to two-thirds.

Another important point to note in this connection is that the electrical system, while cheaper and in general more effective, requires power at practically a uniform rate, a condition fitting in very perfectly with the economic operation of a pumping plant and the requirements of a plant to burn and utilize town refuse.

The matter of disposal of ash-bin or more generally town refuse has not received the attention it deserves. There is but one successful method of handling it, and that is to burn it; but town refuse has a calorific value equal to about one-fifth that of ordinary coal, and consequently may become, with proper arrangements for its burning, a source of profit instead of an expense.

A difficulty in utilizing the heat energy of town refuse for street lighting is that it requires to be burned at a very regular rate the twenty-four hours. To meet this, the so-called thermal system of energy storage has been devised; but since the power required for pumping, supposing some reservoir capacity in the water system, and for the electrical purification of sewage, is in many cases practically constant and more than that obtainable from the refuse, a combination plant would save the expense of such a thermal system and accomplish as much.

It has also been proposed to use such a thermal-storage scheme in connection with lighting plants having a poor load factor, but it may be seen that the following scheme is equally effective and involves very small extra cost. Instead of using separate thermal-storage tanks, by carefully lagging the entire boiler

FIG. 1. MICROPHONOGRAPH TO AID IN EDUCATING DEAF MUTES.

setting and providing removable insulating covers for the fire and ash pit doors, the boilers themselves may be converted into heat reservoirs. When one boiler of a battery is to be put out of service, the fire is allowed to burn as low as possible and the boiler well filled with water, then the fire and ash-pit doors are closed and covered, and the main steam valve to header shut tightly, as well as the damper in smoke flue. Any further steam generated by the remaining fire on the grate and by heat of setting finds its way into the header through a by-pass about the main steam valve. In this by-pass is placed a difference of pressure valve to operate whenever the boiler pressure exceeds the pressure in the header by a certain desired amount. The rate of loss of pressure or heat by such an arrangement can be reduced to an extremely small quantity. Now when the boiler is to be put in operation again it has a pressure equal to or perhaps greater than those in service and brings to their immediate aid its volume of stored energy on a sudden demand for steam. By providing arrangements for starting fires with oil when necessary, the stand-by boilers in a battery can be put into full operation at the rate of perhaps one a minute, or, in any case, quickly enough to meet such sudden demands for steam as occur in practice. I have recommended such a method of handling boilers in small city pumping plants, where, during the time steam is not required for pumping for ordinary purposes, the fires are banked for quickly getting up steam in the event of a fire. This scheme would

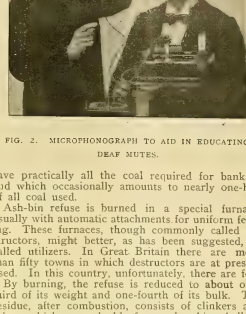


FIG. 2. MICROPHONOGRAPH TO AID IN EDUCATING DEAF MUTES.

save practically all the coal required for banking and which occasionally amounts to nearly one-half of all coal used.

Ash-bin refuse is burned in a special furnace, usually with automatic attachments for uniform feeding. These furnaces, though commonly called destructors, might better, as has been suggested, be called utilizers. In Great Britain there are more than fifty towns in which destructors are at present used. In this country, unfortunately, there are few.

By burning, the refuse is reduced to about one-third of its weight and one-fourth of its bulk. The residue, after combustion, consists of clinkers and ashes, which are valuable for road-making ballast. In the earlier forms of destructors the temperature was not high, but in more recent ones, designed to be odorless, the temperature of the gases is 1,500 to 2,000 degrees F., and the addition of a suitable boiler to absorb their heat is not difficult. Ordinarily, ash-bin refuse will amount to from one to four tons per inhabitant per year. Of course such refuse is a poor fuel, and as it burns with difficulty would seldom be used for steam making. However, it should be burned for sanitary reasons alone, and any profit from the utilization of the heat resulting is clear gain.

It is seen, then, that a destructor plant will combine very perfectly with a plant to supply current for sewage disinfection and for pumping.

For street lighting electricity need only be considered, as the demand for electric illumination, as against other means, is almost universal. But the peculiarity of municipal lighting as compared with ordinary commercial lighting is the constant power required while lights are in use—a feature which again lends itself happily to combination with a pumping plant and plant for sewage disinfection. Also in many cases it will be found that the amount of power required for lighting is not far different from the amount required for pumping. Now from what has been said, it will be evident that in many cases a combined plant can be designed to burn and utilize the ash-bin refuse, do the pumping of water from a series of scattered wells and supply current for street lighting and sewage disinfection, in which all the machinery will be loaded very nearly to full capacity 24 hours a day.

The extremely uneconomical machinery used for pumping in many places to-day, and the demand for better sanitation, offers, it seems to me, a very considerable further field for electrical machinery, and one which I trust will not long remain uncultivated.

The pressure of many recent demands must be my apology for this scant treatment of an interesting subject.

Microphonograph to Aid in Educating Deaf Mutes.

The microphonograph is a combination of the microphone and the phonograph and is the invention of Prof. M. F. Dussand, who occupies the chair of physics in the School of Mechanics at Geneva, Switzerland. This instrument forms the basis of what is termed a system of education of deaf mutes, but which in reality is a method of treating the weak auditory organs scientifically and developing them so that they will perform their natural functions.

To the original apparatus the telephone and the cinematograph have been added by the editor of the Revue Generale des Sciences and the manager of the Paris Telephone Company, who have been engaged in the development of the system. With this combination they are enabled to give to the unfortunates alluded to animated scenes with all the accompaniments of speech, music, laughter and other sounds which nature has heretofore denied them.

The condition of a large number of deaf mutes is explained by the fact that ordinary sounds make no impression on the auditory nerve. This sensitive organ is not infrequently inactive for want of excitation, and, to quote an authority, "movement creates the organ." The usual method of instructing the deaf to speak is the method of visual imitation—that is, the teacher calls the pupil's attention to the movement of his lips, and the pupil imitates as nearly as possible. This method is, of course, very far from satisfactory, although, being the best hitherto known, is constantly practiced in all schools for deaf mutes. But in the system recently inaugurated the sound is repeated as many times as necessary, and the visual example may accompany it. It has also the faculty of teaching modulation of tone, of accent, of musical intonation, all of which are impossible with labial instruction.

M. Gellé relates an incident where an infant of three and a half years, after the fourth lesson, commenced to hear, and distinguished between sound and silence. The word "papa," at first pronounced in a coarse, loud voice, became soft and agreeable after a training of the auditory nerve, through the medium of this instrument.

M. Gellé concludes his remarks on the uses of the microphonograph thus:

"Acoustic exercises through microphonic action render the education of the deaf mute possible from earliest infancy.

"The excitation of the auditory nerve and the nervous cavities of the ear is manifestly superior to all other educational processes, because it follows the natural route of development of the faculty of language, leads directly to the wakening of audition, and provokes the utterance of vocal language."

Experiments have been conducted between Paris and Lille with most satisfactory results. The circuit, a metallic one, led from the telephone transmitter, actuated by the phonograph, to the receiver at the other extreme of the line. So delicate was the apparatus that the sound of the movement of insects was readily transmitted and was audible 250 kilometers away.

It is proposed to exhibit a combination of these instruments in a hall fitted for the purpose, at the coming exposition in Paris, where a vessel will be represented weighing anchor previous to departure, while the song of the sailors, the farewells of the passengers, the sniffling of the sorry and the laughter of the happy will be broken in upon by the shrill whistle announcing "time to go," and the scene will all be enacted as well as the sounds. The vessel will afterward be shown warping away from port, when the orders of the officer, the grinding of the hoisting cable and the "round we go—we're off to-day" song of the tars will mingle with the creaking of the timbers and the labored breathing of the engine.

Coming back to the subject of deaf mutes' education, two illustrations reproduced from photographs are shown herewith, which plainly indicate the impression made by the apparatus. One of the subjects (Fig. 1), 40 years old, had never before heard a vocal or musical sound. The other (Fig. 2), a lad, is listening for the first time to the Marseillaise and beating time to the march with his hand.

The Electrical Shop.

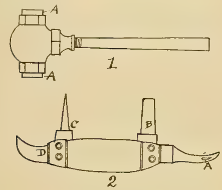
An esteemed contributor sends the following shop hints, which may be of value to the readers of the Western Electrician:

SOFT HAMMER

A good soft hammer for use about the electrical shop can be made without much expense by taking a three-quarter brass globe valve, taking off the hammer head and filling up the globe valve with hard babbitt metal, as shown in Fig. 1. The soft metal portion is marked A. The handle may be either wood or iron pipe.

COVERING EMERY CYLINDERS.

I always size my emery once or twice before using, but I don't wait until it is perfectly dry. When the emery is pretty well set, I reduce glue about two-



FIGS. 1 AND 2. THE ELECTRICAL SHOP.

thirds and go over lightly with a brush or sponge. When dry, I repeat the operation. It does not injure the cutting properties of the emery. After a short use the point of emery will be free of glue. Another way is to give the cylinder a good coat of glue as hot as it can be had. Put the emery into a funnel, holding it about two feet above the roll. Let it run through the funnel onto the roll, and keep turning the roll till it is cold. I do not put any size over the emery, and have no trouble with emery falling off.

A CONVENIENT SHOP KNIFE.

In Fig. 2 is a common four-bladed knife altered to suit the requirements of a belt-lacing tool and general electrical-shop knife. The blade D is to pull out old lace, C to open new holes, B for a screwdriver, and A for drawing wire. The latter blade should be softened and a hole cut for the eye, as shown, and the blade retempered. The blades can be ground to the shapes shown on a grindstone or emery wheel. The hook, awl and other blades all close into the handle, which makes it convenient for carrying in the pocket.

CEMENT ACID TROUGH.

In making a cement tank or vat in which to store liquid mixtures, the first thing to do will be to put in a foundation. To do this, excavate a section of the shop floor, in cellar or basement, about 2½ feet deep and of ample proportions for the size of the vat wanted. This hole should be filled with concrete made of broken stone, cement and sand. The cement and sand should be well mixed before it is wet, about half and half. The large part of this concrete should be stone, using just enough cement mortar to bed the stone. Mix the mortar very soft or wet, then put in the stone and mix all well together. Fill in about six inches of this concrete at a time and ram down solid. Make a box without any bottom out of one-inch board, the size you want the trough, outside measurement. Set this box on top of foundation. Now mix enough cement and sand, equal parts of each, to cover the bottom about half an inch to an inch thick, and spread this evenly over the bottom. Make another box the same as the first, but enough smaller so that when it is set inside of the first box there will be a space of about three or four inches clear around between the two boxes. Fill this space with mortar made of cement and sand in equal parts, using only enough water to make a very stiff mortar. Leave the wooden boxes in place until the cement is well set. The inside box can be removed by cutting a little off the end of two of the boards with a chisel. The cement used, especially what is above ground, should be the best Portland, and the sand clean and sharp. An outlet can be made by taking two pieces of 1½-inch gas-pipe and an elbow, and, when putting in the bottom, bed the pipe in so that the top of elbow will be level with bottom of the tank; the upright piece of pipe can have holes drilled through it at the height you want the contents to stand. A section through the tank is shown in Fig. 3.

MENDING A BROKEN TUBE.

Steel tubing is used in some descriptions of electrical apparatus, and if a tube is fractured, the part can be joined as in Fig. 4, C marking the point of fracture in the tube. To lead the union, plug one end of the tube with putty, run the metal into the other to right [illegible] allow it to harden; then put in a few riv[illegible] the job [illegible] done.

SCREWDRIVER AND HOLDER.

It is often necessary for the electrical machinist to put screws into places where it is impossible to start them with the fingers, and much time is lost fumbling with the screw before it is finally placed. Fig. 5 is a form of screwdriver provided with a divided blade, in the center of which is a push-piece, the latter being of thin steel and arranged to extend through the handle, and provided with a top A. A spiral spring B keeps the push-piece up, when the tool may be used as an ordinary screwdriver. If it is desired to place a screw in a difficult locality, the points of the blade are entered into the screw slot and the push-piece pressed down until the points open, pressing the sides of the slot, and so carrying the screw. The tool is easily made. It is shown in section in Fig. 6.

SOME QUALIFICATIONS.

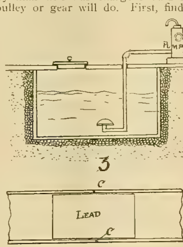
That electrical machinist is the most effective who slowly goes to a machine, quietly stands beside it and watches every part, reads every movement and notes every jar and strain before putting a wrench or screwdriver to it. Such a man may sleepily look on for 10 minues, but, nine times out of 10, when he does alter a part no other change is needed, whereas his excited brother, with soiled face and skinned knuckles, will ply the wrench here and there, loosen nuts and screws promiscuously, and is most likely to put the machine in worse shape than it was.

PRODUCING INTERMITTENT EFFECTS.

Certain operations in the electrical shop require an intermitting stamping effect. In Fig. 7 the shaft carries a flanged pulley continuously revolving in the direction of the arrow. Over this pulley is thrown loosely a belt D, one end of which is fastened to the stamping weight A, and the other end is secured to the floor at F. The weight is guided in parallel uprights and rests upon the base C. As the apparatus stands, the weight is not lifted, owing to the slackness of the belt, but by taking hold of the belt at G with the hand, and drawing it in a horizontal direction a severe tension is created in the belt on the pulley, which latter lifts the weight at a velocity nearly equal to that of its rim. Relaxing the pull on G lessens the tension, when the weight falls freely back to the base. The base may be utilized as an anvil and the strokes from the weight employed in stamping, etc.

CALCULATIONS.

Every man who has charge should know what each pulley or gear will do. First, find the speed



FIGS. 3 AND 4. THE ELECTRICAL SHOP.

of the shaft. Suppose the speed of the main driving shaft is 300 revolutions a minute and that the pulley on the main shaft is 23 inches in diameter, driving a pulley on the motor shaft 20 inches in diameter. Multiply the speed of the main shaft, 300, by the diameter of the pulley on the main shaft, 23, giving 6,900, then divide by the diameter of the pulley on the motor shaft, 20; $6{,}900 \div 20 = 345$ revolutions of the motor shaft.

Electric Light at the Omaha Exposition.

The illumination of the grounds and buildings of the great exposition for which Omaha is now preparing will be profuse and artistic. The fact that Luther Stieringer, the lighting expert of the World's Fair, is consulting electrician for the Omaha Exposition company is a guarantee that the lighting effects will be of a character in keeping with the scope of this great Trans-Mississippi exhibition. Not less than 2,155 kilowatts in dynamos and transformers have already been ordered from the General Electric company for purely illuminating purposes. In detail the contract covers four 125-light (2,000 candle power) Brush arc dynamos of the multi-circuit type; four 120 kilowatt and two 18-kilowatt, alternating-current, high periodicity dynamos, operating at 1,040 volts, together with 840 kilowatts in transformers of various sizes. Current for various power purposes will be supplied from a generator of 225 kilowatts capacity, operating at from 500 to 550 volts. The arc lamps will number 600, of 2,000 candle power each. These are to be of either the double or single carbon type, at the option of the manufacturing company, but if the latter are used they are to be arranged for 14 hour service. The contract also calls for the necessary exciters and all the switchboard appliances for the operation of the above machines.

American Street Railway Association.

The following circular has been issued to supply men by Secretary Penington of the American Street Railway association, with the approval of President Lang:

"The American Street Railway association will hold its seventeenth annual convention at Boston, Mass., on Tuesday, September 6th, continuing in session four days.

"The exhibits and displays of the supply men are so important a part of our conventions that the executive committee, in making arrangements for the meeting, have been as mindful of our wide-awake allies, and as zealous in providing for their convenience and accommodation as for any other feature of the gathering. We have held an executive session at Boston, and give you in this circular the substance of the arrangements we have made in your interests.

"The exposition will be held in the Massachusetts Charitable Mechanics' Association Hall, the largest exposition hall in the country. We will have at least 60,000 feet of floor space, with all the light, heat and power needed. Every applicant is assured that he will get all the space desired, as our resources in this direction are unlimited. The convention will be held on the second floor of the Exhibit Hall, all stairways leading up from the inside, thus insuring the attention of all delegates and visitors to the exhibits.

"The income from sale of space will go to the American Street Railway association. The executive committee of the association has fixed the price at 10 cents per square foot, and ruled that no space of less than 100 square feet will be assigned, but applicants may have as many multiples of this quantity as they may wish. Payments for space should be made to T. C. Penington, secretary and treasurer of the American Street Railway association, 2020 State street, Chicago. Applications for space should be made to Charles S. Clark, 8 Oliver street, Boston, Mass., chairman of the committee on exhibits.

"The Mechanics' Hall association will not allow any nails or screws to be driven in any floor, woodwork or plaster in the building, so those exhibitors who desire to erect booths must govern themselves accordingly.

"All articles intended for exhibition shall be delivered at the building by the agent or owner, and at his expense, but the local committee have made arrangements with Robert S. Brine & Co. to haul and deliver all shipments to the building, if directed in their care.

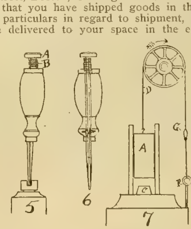
"All electrical connections for power and extra lights must be made at the expense of the exhibitor, and no connection will be permitted except by workmen approved and with the consent of the superintendent of exhibits.

"We expect a large exhibit and perhaps it would be in the interest of the exhibitors to make arrangements to have the building open in the evening, as it is well lighted and the electrical companies expect to make a large display.

"Space must be applied for by August 1st. Assignments will be made as promptly as possible after that date and exhibitors notified of their location. Exhibits of like character will be grouped together and space will be assigned in the order of application.

"It is earnestly requested that all exhibits shall be in place and all work finished by Monday evening, September 5th, which is the evening prior to the opening of the convention. Watchmen will be in charge of the premises, so that exhibits will be safe.

"All goods should be marked to yourselves, 'Mechanics' Building, care of R. S. Brine & Co., 33½ India street, Boston,' sending them bill of lading or advice that you have shipped goods in their care, giving particulars in regard to shipment, and they will be delivered to your space in the exhibition



FIGS. 5, 6 AND 7. THE ELECTRICAL SHOP.

hall. Ship all goods early to insure delivery in time.

"The headquarters of the association will be at the Hotel Brunswick. Hotel Vendome is managed by the same parties, and will be used in connection with the Brunswick. The rates at the Brunswick and Vendome, on the American plan, are \$4 per day and up; Copley Square, Nottingham, Victoria, Turaine, Parker, Young's and Thorndyke, European plan, \$2. The first five mentioned are within five minutes' walk of the hall; the others are downtown, with street cars to the door of the hall. The executive committee advises all who desire rooms

to apply at once, as the rooms at the Brunswick and Vendome are limited, but no rooms will be assigned until March 15th, and will be assigned in the order in which applications are received.

"The executive committee found the Boston brethren so enthusiastic as to the coming meeting, and so hospitable and seductive in their greeting, that success is assured, the location being central and accessible, and the inquiries and information already received being so encouraging, an unusually large attendance seems guaranteed.

"The annual dinner will be held at the Hotel Brunswick, Thursday, September 8th, at eight o'clock p. m. Tickets will be sold at the actual cost to the association.

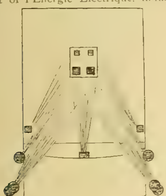
"The railroads will sell tickets on the certificate plan. Be sure and leave your certificate with the clerk the first day of the convention, when you register; it will be signed, vised and ready for you on Thursday, September 8th."

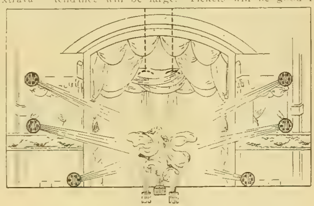
New York Electrical Society.

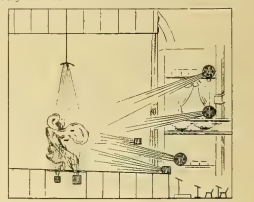
The 185th meeting of the New York Electrical society was held in conjunction with the New York section of the American Chemical society, at the College of the City of New York. Mr. Joseph Wetzler lectured on "Electricity Direct from Carbon." Dr. Charles F. Chandler, Dr. Morris Loeb, Dr. E. A. Doremus, Messrs. Samuel V. Essick, C. O. Mailloux, J. J. Carty, T. C. Martin and Max Osterberg took part in the discussion. The following-named members were elected: Prof Robert Ogden Doremus, Max Loewenthal, James H. Bates, Raymond W. Charles, W. L. Hedenberg, Frank Martin, F. A. Pattison, George C. Hoffman, Thorburn Reid, Robert Lozier, Prof. Sidney H. Short, George Sommer, John J. Swann, Meyer S. Blumberg, Frederick W. Young, Wesley Gray Gilmour, Edwin Adelbert Howe, H. F. Sanville.

Electric Lighting and Fancy Dancing.

The writer of "Chronique Fantaisiste," a department of l'Energie Electrique, indulges in extravagant praises of the young American dancer, Miss Loie Fuller. Much of the effect produced by the graceful dancer may be credited to the arrangement of electric lights and projectors with colored screens skillfully manipulated. One of the dances is described as giving the illusion of an immense flame of punch, and in another the dancer so disposes her costume that "she converts herself into an immense butterfly" with a multitude of tints, which, by aid of the electric lights, serve to heighten the illusion. The crowning feature, however, was the representation of a gigantic lily of the purest white, almost blazing beneath the light of 15 arc projectors. The manipulation of the lights by which these effects are produced will interest the reader, and will be understood by reference to the accompanying diagrams.







ELECTRIC LIGHTING AND FANCY DANCING.

The lamps below the stage are placed about three feet from the glass upon which the dancer stands. They are four in number. The two nearest the orchestra take 30 amperes each and the others only 15 amperes each. Above the stage are two lamps of 15 amperes each, the rays of which are concentrated with the four mentioned. At the right of the orchestra there are three lamps of 15 amperes, one on the stage level, one on the first balcony and one above that at the stage box floor. Two lamps of 15 amperes are placed on the stage, right and left of the curtain, about $5\frac{1}{2}$ feet from the floor. Finally a lamp of 20 amperes is placed at the side of the orchestra leader. The equipment therefore comprises two lamps of 30 amperes, one of 20 amperes and 12 of 15 amperes, making a total of 260 amperes, which at 115 volts represents a consumption of 29.9 kilowatts.

All these arcs are controlled by hand regulators and are mounted in multiple on the Edison central system. The lights are not used constantly. In the lily dance only are all burned simultaneously and the current consumed represents about 35 horsepower.

To handle these 15 projectors not less than 18 men are employed, forming a well trained band, each of whom aspires to the title of electrician.

Naturally the effect of this flood of intense light upon the eyes is harmful and those who have been subjected to it complain of severe headaches

Philadephia Central-station Companies Combine.

It is stated that the consolidation of the electric light companies of Philadelphia has been practically perfected, and that the few companies which have not yet gone into the consolidation will in all probability do so in a short time. The consolidation has been arranged through the Pennsylvania Heat, Light and Power company, or rather by the controlling interests of that corporation. The consolidated interests will be vested in a new operating company, the Pennsylvania Manufacturing, Light and Power company, which has been incorporated under the laws of New Jersey and has an office in Camden and a main office in Philadelphia. This company is organized with a capital stock of $15,000,000. It will also issue $15,000,000 of 50-year five per cent. gold trust certificates to be used in purchasing the stock of all the electric-light companies in the city. This amount, it is estimated, will be sufficient for that purpose.

The International Convention.

The international electrical convention at Laredo, Texas, will be held next week, from the 9th to the 12th. All visitors are urged to be prompt in attendance at the opening session at 10 a. m. on Wednesday, March 9th. For this meeting the International and Great Northern Railway company and connecting lines in Texas, New Mexico, Oklahoma, Arkansas and Louisiana will make rates based on the 167-mile-distance plan, as follows: Less than 100 miles, $3 for round trip; 100 to 167 miles, $5 for round trip; beyond 167 miles, one cent per mile each way added to the rate of $5 for that distance. Thus if one is 167 miles from Laredo it will cost him $5 for round trip; if 200 miles, $5.66 for the round trip, and so on. This is the lowest basis used for any organized meeting. Visitors, as well as members of the associations, can take advantage of this rate, and it is expected that the attendance will be large. Tickets will be good for eight or 10 days. Return limit may be extended at Laredo for those who wish to visit the interior of Mexico.

National Electric Light Association.

The date for holding the annual meeting of the National Electric Light association at Chicago has been fixed for June 7th, 8th and 9th. The sessions will be held at the Auditorium, which will be the headquarters of the association during the meeting. The banqueting hall has been secured for the meetings. Secretary Porter, during his recent visit to Chicago, arranged the details for the convention, and the executive committee has since approved the plans.

President Insull is now engaged in preparing the programme for the meeting, and he promises that it will be of unusual interest, as several live subjects will be considered.

Storage Batteries for Chicago Fire-alarm Service.

In accordance with his scheme to replace about 2,000 gravity cells with storage batteries to furnish current for the fire and police telegraph circuits of the city of Chicago, City Electrician Ellicott received bids on February 26th for 900 cells of secondary battery of 10 ampere-hour capacity and 300 cells of 150 ampere-hour capacity. The Police Telephone and Signal company of Chicago offered to supply chloride accumulators for the whole outfit for $4,350; the American Battery company of Chicago tendered the installation complete for $4,500, and Sipe & Sigler of Cleveland put in a bid of $1.20 each for the 900 smaller cells. All bids were furnished with the guarantee that the yearly cost of maintenance for the batteries should not exceed $7\frac{1}{2}$ per cent. of the first cost. It is estimated that by replacing the existing primary batteries with storage cells, the city will save at least $5,000 a year by reducing the expense of keeping up the plant.

The contract for the larger batteries was awarded to the American Battery company for $3,150 and for the smaller cells to Sipe & Sigler for $1,080, making the total cost $4,230.

Pan-American Notes.

Complaint is made by importers in Buenos Ayres, Argentine Republic, of the condition in which the electrical apparatus shipped to them arrives, owing to the injudicious manner of packing. An instance is cited of an American firm having sent a large number of incandescent lamps to that market, which upon arrival were found to have suffered a large per cent. of breakage. Simultaneous with this complaint the statement is made that similar shipments from England had arrived in much better condition. The importance of this matter is manifest.

The Western and Brazilian cable, between Pernambuco and Ceara, and the Amazon cable, extending from the mouth of the river to Manaos, which have been broken for some time past, have been repaired and messages are again transmitted regularly.

The government of Guatemala has recently promulgated a decree admitting electric batteries, uncharged, intended for public use, free of duty. Galvanized iron wire and insulated copper wire for electrical purposes and electrical apparatus are subject to a duty on the basis of their gross weight. Guatemala, like other countries, is introducing in its principal cities the system of electric lighting.

The syndicate operating the street railways of Mexico is preparing to introduce electricity as the motive power. The company owns about 140 miles of road, and it is purposed to equip the entire line, including the connection from Guadalupe to San Angel, with electric power. It is estimated that the total cost of the new service will be about $5,000,000, and opportunities will be given all electrical manufacturers to bid on it.

The system of lighting the city of Lima, Peru, by electricity is beginning to be adopted, and it is thought that within a comparatively short time it will supersede the present mode of lighting by gas altogether, both for private and public use. Many of the other principal cities of the republic are interested in this subject, and the opportunity for American manufacturers of electrical apparatus is very favorable.

The concession which was granted in July, 1896, for installing an electric-tramway system in the city of Caracas, Venezuela, has been declared forfeited, owing to the failure of the concessionaire to comply with the terms. At present Caracas has a very imperfect street-railway service, and the lapse of the former grant opens a desirable opportunity for American capitalists interested in the promotion of such enterprises.

American Institute of Electrical Engineers.

Last week's meeting of the Institute was attended by about 75 members and guests. A paper on the "Single-phase Induction Motor" was read by Mr. Steinmetz and was discussed by Prof. W. S. Franklin. Dr. A. E. Kennelly, E. E. Ries, Townsend Wolcott and others. At the meeting of the executive committee in the afternoon the following-named associate members were elected: Frank Broili, San Francisco, Cal.; Samuel Byington Libby, West New Brighton, N. Y.; Otto T. Louis, New York city; James A. Mortland, Cedar Falls, Ia.; Charles H. Schum, New York city; C. E. Sedgewick, San Francisco, Cal. William Goltz of Milwaukee was transferred to full membership.

COMMUNICATIONS.

Dynamo Catalogues Wanted.

To the Editor of the Western Electrician:

I would like catalogues of dynamos and motors, as I am in the market for this class of material.

R. ANDERSON.

Chicago (69 Twenty-third street), February 23, 1898.

Electrical Reduction of Ores.

To the Editor of the Western Electrician:

I have control of fine water power within easy reach of rich zinc, copper and lead lands. I wish to investigate the electrical reduction process as applied to these ores. I would like to correspond with gentlemen who can give me this information.

ROBERT A. MOORE.

Springfield, Mo., February 23, 1898.

Western Electrician.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

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Four Years' Record of Electric Light Convention Advertising.

Issue	Number of Advertising Pages.	Whole Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894....	40	56	4,145
February 23, 1895.	52	68	5,593
May 9, 1896......	72	88	7,575
June 12, 1897.....	80	100	8,643

No other electrical journal has ever equaled this record of 8,643 square inches of genuine full-paid advertising in a single issue.

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The circular issued by Secretary Penington to the supply men on behalf of the American Street Railway association is printed elsewhere this week. The executive committee has been especially attentive to the wants of that influential auxiliary this year, and in return it is expected that the exhibition in connection with the Boston convention shall be the most pretentious affair ever conducted by the organization.

If it is true, as the London Electrician asserts, that "there is a splendid field for British-made electric-traction plant in America, as every electrical manufacturer in this country well knows," it must be admitted that the field has been woefully neglected. The "British-made electric-traction plant" is not known here, and yet there are many electric railroads. Perhaps our contemporary's say-so was "writ sarkastic."

Announcement is made elsewhere of the dates selected for the annual meeting of the National Electric Light association, and members of that body and others who are interested in it will begin to form their plans so as to enable them to attend. The fact that Chicago is the meeting place has already determined many to attend who might otherwise stay away. This city is to-day one of the greatest electrical centers of the world, if it does not occupy the foremost position exclusively. In many respects, indeed, it may justly be accorded that distinction. The electric lighting interests are well represented here, and the methods employed in conducting the business of generating and supplying current will form an interesting subject for central-station men in other parts of the country.

The time selected should also prove advantageous to the association, as it will enable many to devote what may be termed their holiday time to this visit. They will find the trip both entertaining and profitable, and will be well repaid for any sacrifices they may make. Everything seems to point to an unusually large attendance this year.

Now that the date has been fixed other details will be taken up at once, local committees will be appointed by President Insull and the programme will be arranged. Entertainment will be provided for visitors and all will be assured of excellent accommodations in every respect, an advantage that has not always been enjoyed at conventions of electrical bodies.

An ingenious Russian engineer has suggested to one of the scientific associations of St. Petersburg a plan of construction of aerial lines that has attracted considerable attention. He proposes a suspended electric railway which will be constructed at an elevation of 10 to 21 feet above the level of the earth. The carriages will move on rails fixed to brackets on columns or pillars. As there will be double tracks, trains moving in opposite directions cannot interfere with each other. The speed at which such a road could be operated with safety has been estimated at 200 miles per hour. The inventor suggests three applications or distinct types of his system, the first being for small parcels and postal packages, the second for merchandise of bulkier character and medium weight, and the third for packages of greater dimensions and for passenger service.

The construction of the first-named type would be inexpensive and without difficulty, and the low cost of operation would also recommend the system. Of course for longer routes the expense of construction and operation would increase because of the greater demand for current. The second type would be for general freight traffic, and the third form, which would serve for freight and passenger service, is more interesting than either of the others. The weight of the cars loaded is estimated at 600 pounds, and the speed to be maintained 200 miles an hour. The passenger coaches will contain 20 persons. The windows in these are to be placed at the ends of the coaches only, to prevent nervousness on the part of passengers.

Discussion of methods of teaching employed in the technical schools of Germany is occupying considerable attention in educational circles. Professor Adolf Slaby of the technical high school at Charlottenburg contends that the universities have had no direct share in the application of science to industry, and in support of his position he relates an excellent story upon von Helmholtz. He says: "Practical teaching is abhorred by the professors at most of our universities. I recollect atending a lecture by Helmholtz where I expected him to give some explanation of the dynamo. After making some theoretical observations he merely said: 'Acting on these principles people have constructed some very ingenious machines called dynamos, for engineering purposes.' That was all Helmholtz would deign to say about the dynamo."

According to Prof. Slaby the professors of to-day are just the same in this respect. Their teaching is purely scientific, philosophical, philological and historical, and has not varied for three centuries. He admits that the greatest discoveries in physics have been made in the university laboratories, but the application of these discoveries has been neglected by the universities. Pure science is their aim, and those who, without concerning themselves with studying the phenomena of nature, devote their whole efforts to giving their pupils the means of turning science to practical account are despised by the university scientists. Prof. Slaby's complaint is reiterated by many eminent authorities throughout Germany, and his position has many supporters among those who have examined closely the system of education adopted in the German universities.

Plans have been prepared by the Chicago City Railway company for the extension of several lines and the electrical equipment of others now operated by animal power, for which improvements and additions it has already secured franchises. Additional ordinances are now pending in the council for still further extensions of the company's electric system, and permission has been asked for the temporary equipment of the down-town cable lines with the overhead trolley to enable the company to give uninterrupted service during the period occupied by the track-elevation at Sixteenth street. Mayor Harrison has notified the company that its request for permission to string overhead trolley wires on Wabash avenue, State street and Michigan avenue, in the heart of the down-town business district, will not be granted. He contends that the electric cars can be hauled down-town as trailers by the cable cars, but according to Superintendent Nagle of the South Side company this plan is impracticable for two reasons: First, he says the present power plants of the cable system are taxed to their full capacity and the building of additional power houses for this temporary work would be out of the question; secondly, the number of cars operated on the trolley lines has grown so great during the last two years that to attempt to go back to the old method of handling this traffic would merely invite certain blockade of the entire system during the busy hours when the transportation facilities are mostly in demand.

Interest in the problem is increased by the suggestion that opposition to the trolley would at once disappear if the people had an opportunity to judge of the merits of the system by actual experience. The subject has more than local interest, as the present movement against admitting the trolley even temporarily on the principal streets in the down-town business district is recognized as the culmination of the effort to create public sentiment adverse to that method of propulsion under the conditions that obtain in this case. While it is a fact that the trolley has already invaded the business district of Chicago, as well as other large cities, it is also true that it has been excluded from the busiest retail districts. Once admitted, it is feared by the opponents of the system, it will be no easy task to dislodge it. It is recognized that superior service could be given by the trolley, and this improvement, it is feared, might influence many who are now opposed to the stringing of overhead wires to withdraw their objections.

It is not clear just how the mayor can withhold the permit requested by the street railroad company for temporary occupancy of the streets with its trolley lines without inflicting great hardships upon a large class of people. It is thought by many that the mayor is really hopeful only of compelling the company to make certain concessions as a return for the privileges it now seeks.

Economic Effects of Present Copper Production.

By Franklin H. Wentworth.

Life, under ordinarily onerous conditions, is pursued by artisans and followers of the liberal arts and sciences with but scanty attention to the economic phases of their professions. Abstract reasoning is to most men an impossibility. The result is that the great majority of them accept conditions as they find them and struggle merely for individual supremacy. It is not contended that this struggle does not make for high specialization of industry, or that competition is not a desirable, nay, a necessary factor in all civilization that trends upward. Socialists ignore this fact and regard competition as an evil. As a class they may be said to represent purpose without knowledge. All clear thinkers now, however, distinguish between unrestricted and restricted competition, and the latter is rightly regarded as an evil. Whenever natural opportunities are open to mankind it follows that employment and a living are possible to each individual, and he of the larger brain, greater brawn, or other inherent superiority, takes his place naturally at the head of the procession. Men do not begrudge success to real superiority.

When Edison's discoveries made incandescent lighting commercially possible there was created a sudden and imperative demand for electricians. In consequence, mechanics of every degree of intelligence and competency quickly arrogated to themselves the dignity of this title. The early balance sheets of purveyors of electrical energy are interesting for what they do not show. The present economies practiced in central-station management were undreamed of 10 years ago. In obedience to the law of supply and demand intelligence flowed in this direction. Colleges and universities quickly responded with new or enlarged electrical departments, and the intelligent electrical engineer soon began to displace the destroyer of armatures and drive him back to his simple mechanics. The efficiency of generating apparatus was heightened by improvements in design, electrical publications gave preferred space to articles upon the economy of central-station operation and management, and the entire business, from the water and coal supply to the filament of the incandescent lamp, was subjected to the closest scrutiny, with the purpose of reducing the cost of operation to the lowest point possible.

Although, of course, greater economies may be practiced in large stations operating large units and with their fields of distribution within short radii, it may be said that, considering the character of present generating apparatus and the methods of its operation, central stations in general have attained a high degree of efficiency and economy of management. Capital, in possessing this known factor, may, therefore, with a given cost of fuel delivered at the furnaces, make comparisons as to distribution of population in districts to be supplied with current and calculate with a fair degree of accuracy its probable investment return.

A review of statistics obtainable shows that only in large cities does electric lighting and power supply bring a return sufficiently great to prove really attractive to capital. There is profit in large quantities of current supplied to consumers at comparatively short distances. Why? Because the investment in copper feeders is not so great as to demand too large a portion of the station's earnings for the interest account. In the smaller cities the extension of central-station service practically ends when the progressive merchants in the business district have been secured as customers. Generally in such cities not five per cent. of the residences are lighted electrically. This is not because the householders fail to recognize the superiority of the incandescent lamp as an illuminant, but because its cost renders its use comparatively prohibitive. It is generally conceded that the introduction of electricity for lighting has not impaired the profits of the gas industry, but, on the contrary, has materially increased them. People have been educated to use more light, and where the incandescent light has replaced the gas burner in one place it has promoted the use of two burners where one was before considered sufficient. The sale of the current consumed by a thousand incandescent lamps burning in residences should be as profitable as that consumed by a thousand burning in stores, the loss in resistance of conductors being equalized for the greater distance from the station by a proportional increase in size of feeders. Central-station managers, however, agree that they cannot light residences to any appreciable extent because the outlay for copper necessary for residence distribution makes such service commercially impossible. When every economy possible has been practiced at the station, when all the paying business in sight has been secured, or at least struggled for, when money has been sunk in vain attempts to compete with gas upon the same basis, and when apparently nothing further remains to do but to accept the situation and try to live in spite of unsatisfactory balance sheets, the thoughtful central station manager becomes unconsciously an economist. In other words, he begins to contemplate the business of electric lighting generally, and attempts to sum up its possibilities and measure its retarding influences, irrespective of local conditions. At this point he becomes of value to society as a whole. The same point is reached by the electrical engineer when, having compared the really small number of technical schools and the number of students graduated from them with the almost limitless possibilities of electrical development, he ceases his silly twaddle about the schools turning out too many electricians, and seeks for the causes which stand in the way of their employment. The central-station manager now divides his economic problem into three primary factors—fuel, translating media and medium of delivery or distribution. Taking up the first of these factors, he sees that he is paying a monopolistic tax both to the owners of coal lands and to the transportation companies. He reads the newspapers and clearly sees that this excessive tax upon his fuel is used for dividends on capital stock which does not represent tangible assets, but which derives its value from the power to monopolize part of the earnings of his central station. Of course he shifts this tax upon the consumers of current, but not all of it. His business suffers if his prices are too high; so he must pay part of the tax himself by accepting more modest wages of superintendence, or by cheapening his help. The latter policy is, of course, reactionary for obvious reasons. At this stage of his inquiry he may have a glimmering idea of the ethical side of production, and wonder why the Creator furnished coal to a few men when all men need it; but it is only a momentary thought, quickly dismissed as socialistic in tendency. Then, too, he sees that he is not the only sufferer. Every fellow manufacturer, whatever he may be producing, pays the same tax, and, like himself, is unable to shift all of it upon the consumer or upon his help. Turning then to the second factor, or translating devices, he sees that he here too pays a tax over and above the cost of production and a legitimate profit on capital invested; but he sees that in this factor the tax is due to the legal monopoly of the patent, which he believes to be a justifiable monopoly, necessary for the encouragement of invention. This brings him to the third and final factor of the problem, the medium of distribution, and he finds here a monopoly, similar in character to that of coal, but which, unlike the latter, does not operate upon all producers alike, but constitutes an excessive and discouraging tax upon electrical industries alone.

The present price of lake copper is 11 cents per pound, although it is conceded that it could be produced at a very good profit to mine owners at six cents. Taking the famous Calumet and Hecla mine of Upper Michigan, we learn that during last year a dividend of 45 per cent. was paid to its stockholders, payments being made quarterly. This enormous profit is, of course, mainly due to the richness of the copper vein, the private ownership of which, with others, constitutes a monopoly. The Dingley bill places a duty of 2½ cents per pound upon foreign copper, hardly necessary as a protective measure, one might think. This same company, besides its dividends and expenditures for betterments during the year, has erected a club building for its employes at a cost of $20,000. No capital, subject to competition and unassociated with privilege, can yield in normal times more than five per cent. per annum; hence eight-ninths of the 45 per cent. dividend of the copper company represents merely the power to lay the entire electrical industry under contribution to that extent. The erection of a $20,000 building for employes is a creditable thing; better far than spending that amount in riotous living; but, economically considered, the company does not pay this money; it assesses the amount upon consumers of copper and merely directs its expenditure in the manner stated. Owing to the rapidly increasing use of electrical machinery, copper is becoming an indispensable factor in the industrial world. Its abnormal price will, of course, continue indefinitely to operate as a restriction upon the industry of all the people, for the benefit of the small number of men controlling its output. The manufacturers of wire and electrical machinery must of course add the full cost of copper to their products and thus shift the tax onto the central-station manager and the consumer. The conversion of the copper ingots into commercial forms must be done at the least possible expenditure for labor in order that the manufacturer may compete with the other manufacturers. Thus wages tend to the lowest point at which it is possible for electrical workmen to live. A rise in the price of copper means loss to the manufacurer, or he must recoup by cutting wages. This may precipitate a strike, that most unintelligent and useless of all useless things. For economically it is not an issue between labor and capital, but an issue between labor and capital on one side against monopoly on the other. This is what economists mean by restricted competition. So long as labor and capital are denied free access to the resources of the earth, from which all wealth is obtained, free competition is impossible. As has been indicated, electricians will continue to struggle against one another for a livelihood, denouncing the colleges for their fecundity and assigning other superficial and unintelligent reasons for the stress of living, until competition becomes finally so restricted as to make the conditions of employment too onerous to be borne. They will then begin to think, and slowly get at the real economic bearings of their professions.

What is the real remedy for economic conditions under which it may be impossible for many worthy electricians to find employment and for many central-station managers to live? Is it the socialism which demands that all ore and coal mines shall be controlled and operated by the general government? To assent to this is to exhibit a stupid misapprehension of the real functions of government. Our republic was not designed to restrict, but to leave free. Every individual should be free to acquire whatever his intelligence and natural advantages may enable him to secure, so long as he does not infringe upon the rights of his fellow men, who should enjoy the same freedom.

We see that the holding of copper, coal and other mineral lands out of use, in order to obtain extravagant prices to enrich a limited number of men, operates to retard the development of industry, and thus does really interfere with other men in their effort to make a living in their chosen professions. Government should, therefore, not add restrictions, but remove them, just in so far as they operate to the benefit of some men at the expense of other men. Such governmental action would leave men free to employ themselves, which is just and right. This desideratum could not be obtained by creating new and false functions of government, but by simply changing the method of applying an already clearly established and necessary function. We at present tax all machinery used in production. If a mining company purchases a new pump, hoist or other machinery, its tax is increased. Why do we do this? Do we wish to restrict production? If we tax dogs, dogs decrease in number. There is no doubt as to the economic effect of the operation of any tax. We will never succeed in increasing the output of copper by jumping upon the man who attempts to do what we really want him to do—dig more ore from the earth, and use more labor and machinery in doing so. But if we simply take the tax off all machinery of production and put it upon the value of land, it will encourage the owning and using of mining machinery, and discourage the holding of rich mining land out of use. For in order to pay the tax upon the value of the land the mining companies would have to produce industriously, employing more labor and machinery; they could not hold valuable mining land out of use, for the reason that the taxes on the value of the land held unproductively would eat up the profits upon the limited amount of ore they were producing. They would have to get out the ore to pay the tax upon the value of the land. Increased production would necessarily follow. Ore would be cheaper, and the restriction now operating to retard the development of electrical industries effectually removed.

There is another economic effect due to the present monopolization of copper production which is of uncommon interest and value. When we find a great stone in the way that seems too great to remove, we straightway set about to make a path around it. The present high price of copper has proven a stimulus to inventors to bring out many ideas that would have lain dormant with low-priced copper. This shows encouragingly in the development of polyphase systems, and in the comparatively rapid progress in all high-potential work, which alone has, so far, made long-distance transmission commercially possible. It must be plainly seen that all such development is a direct result of attempts to evade the tax of the copper producers, which is an added proof of our proposition that a tax always operates to discourage the use or possession of the thing taxed. There is but one single exception—a tax upon land values. When thus applied it stimulates production and discourages the holding of land idle. In other words, it promotes the best use of the earth for the benefit of those living upon it at any given time, thus coinciding with the ethical idea.

Mexican Telegraph Service.

In a recent report to the State Department at Washington, Consul-general Donnelly of Nuevo Laredo says that an interesting phase of government ownership is being presented in Mexico, where the government operates a telegraph line of its own in competition with the lines of the several railroads. Advocates of government ownership would doubtless expect the government service to be the cheapest and best, but such is not the case. The railroads give the promptest service and generally lower rates. The following table shows the government and railroad telegraph rates on 10 words from Nuevo Laredo to the cities named:

	Government rate.	Railroad rate.
Monterey	$0.40	$0.26
Saltillo	.60	.51
San Luis Potosi	1.20	1.16
Mexico City	1.60	1.61

As a natural consequence the railroads have done the great bulk of telegraph business, both foreign and domestic.

Consul-general Donnelly announces that by the recent arrangement between the Mexican government and the Western Union Telegraph company of the United States the latter cedes to the government the sole right to that company's Mexican business, and the Western Union, in return, obtains the business of the federal telegraph lines. The government has also issued an order prohibiting the railroads from handling international messages. The effect of this will probably be to deprive the railroads of considerable business, and to give the Western Union control of the international telegraph service.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Exchange Management.

By S. A. Duvall.

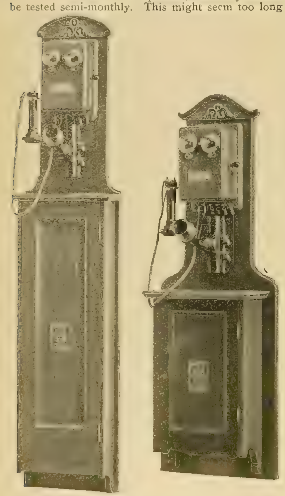
The management of a large opposition telephone exchange differs greatly from the old Bell methods. There are three important points to be kept in view by an exchange manager.

(1) Untiring attention to details.

(2) Unfailing courtesy to the public on all occasions, no matter how trying.

(3) Judicious economy.

In regard to the details of an exchange and the subscribers' stations, it will be found necessary to have a fairly well equipped repair shop. In the first years of the new companies a great many instruments were manufactured with very few of the advantages of patents and experience that now can be had. These instruments can be removed to the repair shop and there be remodeled, one at a time or in lots, at very little expense. Again, where inspectors have failed to put an instrument in good order, and troubles are apt to become chronic, repairs can be made at the shop under the experienced eye of the superintendent. Delicate switchboard cords can be repaired and kept in order. These are the most important functions of a metallic switchboard. Broken or cutting-off cords should never be allowed to remain in the board after notice has been received from the operator, and they should be tested semi-monthly. This might seem too long



MASON PAY-STATION EQUIPMENT.

a time unless a good make of cord is used, such, for instance, as has tinsel conductors with a spiral spring and a tightly woven linen cover, reinforced by another spiral spring and covering extending at least one foot from the connection in the plug.

The circuit charges can also be removed, cleaned and repaired in the shop without disturbing the operator, providing duplicates for one or two sets are kept in stock. This work, of course, comes under the switchboardman's duties. A great deal depends upon having an efficient switchboard or repair man. He should also have charge of and keep in good order the operator's microphones. These in large exchanges should be charged from storage batteries. The writer prefers small cells, having a complete set for recharging. He does not think 48 hour periods are too short; of course larger cells may be used and need be less frequently charged. If the repair man possesses versatility and is not kept too busy, he can act as test clerk, receiving all trouble tickets, locating the troubles found in the exchange, such as a tight annunciator drop, a defective jack or joint, or a blow out fuse. These he can repair himself, thereby saving the lineman or inspector a long and unnecessary trip. A conscientious chief operator is a necessity, one who will not fail to report troubles to the manager. The inspectors must be taught that they can never leave an instrument which they have not satisfactorily repaired. Much trouble can be avoided by the use of good hand cords, those having sealing wax at their terminals should never be used. A good cord should have some means of fastening the weight of the hand 'phone to an eye on the side of the generator box. The tinsel should be soldered to the terminal. Linemen and inspectors in the rapid growth of a new exchange are apt to neglect soldering all joints. In the writer's experience he has found there is nothing "just as good" as a soldered joint. This is not merely a text-book theory.

Inspectors should never fail to be provided with emery cloth. It should be used to clean all connections, especially the microphone contacts in an instrument. Some manufacturers were too economical in using platinum for contact points. The latter should always be well supplied with a pure grade of sal ammoniac and well amalgamated zincs. It is well for new exchanges to spend a few more cents per pound and get the best. Periodical inspection of instruments by districts, at least every quarter, called "service inspection," has been found to be a good means of bringing in delinquent rentals. The inspections can be made by the regular inspectors, who, having a certin district, can perform their duties by being notified through the telephone from the chief operator, who should keep a tally-list and check the reports as they are made by her. This inspection should consist not only in a thorough overhauling of the instruments, but examination of the rapidity with which the operator answers calls. Other points to be noted are whether the telephone is in a good location and the subscriber knows how to use it, also whether he is provided with the latest catalogue, and if he is in need of any auxiliary instruments, such as a desk 'phone or extension bell. The chief operator should keep a book for entering all the complaints, the name of the inspector or trouble lineman who has gone upon the complaint and what time he reported the same adjusted. In regard to a switchboard of 2,000 line capacity, much has been said and written. When the opposition exchanges of over a thousand lines were started there was a great deal of talk about the necessity of a multiple board. It was said that the Bell company was the only concern that had one, and that it had it so well covered with innumerable patents that it would be impossible for an opposition company to have a board of over one thousand lines that would work successfully. Now that has been actually demonstrated to be a fallacy by the number of large independent exchanges scattered throughout the country. The writer does not mean to say that the multiple board used by the Belll company is not a success, but he believes that an exchange with proper sub-offices can give good service, as well as pay good dividends, without a multiple jack board.

An argument advanced by the Bell company is that the larger an exchange grows the more expensive it is to maintain. The reason given for this is thus illustrated: If John Smith is connected to a 100-line exchange the remaining 99 subscribers are maintained for the use of John Smith. If it is a 200-line exchange, there will be 199, if a 300-line exchange there will be 299, and so on. Now to the public this would seem reasonable, but upon investigation a telephone exchange is found to represent a little world by itself. In New York a Fifth avenue subscriber holds very little communication with the Bowery. Hence we find telephone subscribers have their circles of communication, and that the west end of a city has more local communication than calls for the east side. If the manager of an exchange appreciates these facts he may, by properly subdividing his exchange, increase the efficiency of his service as well as the revenue. But these are only a few of the details of a new exchange. If the manager is diligent in attention to details he will find a great many improvements upon the old Bell methods. Lack of courtesy was one fault and is even now a weak point with the Bell. To be answered in a sharp voice. "Well! what number do you want?" and, upon a subscriber endeavoring to report an instrument badly out of order, to be answered "Well, we know what's the matter with your telephone," are not calculated to increase the success of any business or firm, even if it enjoys a monopoly. The manager of a new exchange must always be bland and mild and must instill this manner into all his subordinates. He must instruct his chief operator to give all information possible, such as the numbers of new subscribers, and any information that a subscriber may desire. Courtesy should consist not only in manner, but the needy subscribers should be met halfway in demands for special switches and devices. With a little ingenuity and at a nominal cost, many good friends can be made without any loss of revenue.

In regard to economy it may be said that it does not pay to have deadheads employed in an exchange, or special agents, no matter what their political influence. It is a mistaken idea to compel women to work long hours. Eight hours in a telephone exchange is sufficient, and an operator cannot give satisfactory service after that time, nor should she be employed elsewhere. After the eight-hour limit the most amiable operators may give sharp replies to irritable subscribers and become slow in answering calls. Men do not give satisfaction as operators, as they are apt to become rough in answering calls and in the manner of handling the switchboard. Where there are 40 or 50 employed is is best to compel them to furnish substitutes when absent. The writer has heard of prizes being offered to operators giving the best service and having the fewest complaints during the month. It is doubtful whether this works successfully from a business view.

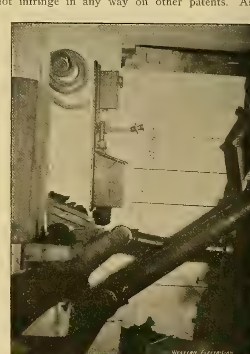
Independent exchanges should employ experienced men, give good service, and success is assured.

Telephones for Mines.

One of the many new uses that telephones are being put to is connecting various sections of mines with the surface mills. The accompanying illustration shows a Stromberg-Carlson telephone in the Stewart mines at Butte, Mont. The instrument is at a pump station 600 feet below the surface, and furnishes valuable service in affording means of communication with other points about the mine without the necessity of making a trip. The instrument was installed by W. I. Jackson, manager of the Montana Electric company of that place. Experts say that mines are probably the most trying places for apparatus of this kind, being continually subjected to dripping of water and dampness from the walls and pipes, and to the roughest kind of usage.

Mason Pay-station Equipment.

Up to the present time it has been impossible for independent telephone companies to secure automatic pay-station apparatus, for the reason that the Bell company has controlled the appliances designed for that purpose. Now the Mason Telephone Pay-station company of Ludington, Mich., offers what it claims to be a thoroughly reliable instrument at a moderate cost, and one that does not infringe in any way on other patents. Aside



TELEPHONES FOR MINES.

from the inconvenience of having to arrange for some person to look after the toll business at pay stations, it has been demonstrated that the business is largely increased wherever this class of instrument has been introduced. This instrument is designed for use in public places, depots, hotels, restaurants, corner drug stores, etc., without attendant. The cuts show a standard wall set with battery space, and another type without battery.

Southeastern Iowa Telephone Notes.

[Special correspondence of the Western Electrician.]

The Jefferson County Telephone company of Fairfield, Ia., has been in operation six months. The company opened its exchange with 57 subscribers on September 15, 1897, and at present it is furnishing excellent service to 123 subscribers.

To obtain a franchise to use the streets, alleys and public places in any city or town in Iowa, it is required that the project be submitted to the voters, under section 776 of the Code of Iowa for 1897.

W. R. Hind and others have been granted a franchise at Mount Pleasant, Ia., subject to the approval of the voters in the coming spring election.

E. T. Keim of the Northwestern Telephone Manufacturing company of Milwaukee is organizing a Home company at Centerville, Ia.

It is rumored that J. C. Hubinger will build an exchange at Muscatine this spring.

Iowa Independent Telephone Association.

The annual meeting of the Iowa Independent Telephone association, composed of the anti-Bell companies in the state of Iowa, will be held next week in Des Moines, beginning Tuesday, March 8th. A good meeting is expected. E. K. Himes of Oskaloosa is the secretary of the association.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The officers of the American Telephone and Telegraph company at Minneapolis have been cited to appear before the county auditor and make a disclosure of the company's taxable earnings. This is an outgrowth of the action of the state auditor, who sent the company the usual blanks for a return of its property. The blanks were returned with the statement that the company had nothing to be taxed on, as it did only an interstate business. After the disclosure the taxes will probably be assessed and the matter allowed to go to the courts.

The Wisconsin Telephone company is preparing to follow the Wisconsin Valley Telephone company into the northwestern part of Wisconsin, taking in Ashland, Washburn, Bayfield, Sanborn, Mellen, Hurley, Bessemer and Ironwood with a long-distance line.

The farmers in the district around Baraboo, Wis., are arranging to secure telephone connection. A line will be built in the spring connecting with Richland Center and Reedsburg.

The Iowa Telephone company has been granted a franchise by the council of Denison, Ia. The mayor, it is understood, will veto the ordinance.

W. C. Wyckoff & Co. have bought out the Clark Automatic Switch company at Rock Rapids, Ia. The new owners will make some improvements to the system.

The Northwestern Telephone Exchange company has bought the Austin telephone exchange at Austin, Minn., from W. S. Willis, and will make a number of improvements.

H. H. Ashley secured judgment for $500 against the Rocky Mountain Bell Telephone company at Helena, Mont., for damages sustained by the company removing his telephone from his livery stable. He tendered the company the money for current service, but it was declined, owing to a dispute over an old bill.

The South Line Telephone company has been formed at Mount Ayr, Ia., and materials have been purchased for the construction of part of the line.

The Barron County Telephone company of Barron, Wis., proposes to put in local exchanges at Prairie Farm and Chetek, as well as connection with Rice Lake.

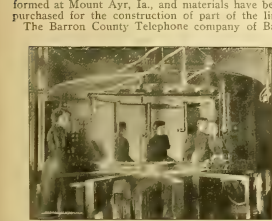


FIG. 1. PEOPLE'S TELEPHONE EXCHANGE, KNOXVILLE, TENN.

The council of Alma, Wis., is considering a franchise for the Fountain City Telephone company.

J. W. Johnston, formerly manager of the La Crosse Telephone company, at La Crosse, Wis., has gone to Menomonie, Wis., to act as superintendent of repairs for the Wisconsin Valley Telephone company.

H. F. and W. S. Proctor of Viroqua, Wis., are working up interest in a local telephone system for Spring Valley, Minn.

Efforts are being made to form a company and build a telephone line between St. Peter and Winthrop, Minn.

The telephone company at Rush City, Minn., has let the contract for material for an extension to Cambridge, Minn., from Stanchfield, and between Grass Lake and Brunswick.

Otto Wertzstein, Jr., of Rochelle, Ill., is an applicant for a telephone franchise in Wadena, Minn.

C. B. Miller of Clinton, Ia., is considering the possibility of securing a franchise for a local telephone exchange at Maquoketa, Ia.

The Wisconsin Telephone company is arranging to rebuild its lines in the vicinity of Baraboo, Wis., putting in long distance and all metallic circuits.

It is reported that the Northwestern Telephone and Telegraph company is arranging to build a toll line from Oshkosh, Wis., to Marquette, Mich.

H. M. Orlady and Dr Gober have completed arrangements to establish a local telephone exchange at Marshall, Wis.

The Midland Telephone company of Ellendale, N. D., is arranging to extend its lines from Aberdeen, S. D., to Manning, N. D. Oakes, Kulm, La Moure, and later to Cogswell and Fargo.

Dr K. W. Droge and others will canvass Marshfield, Wis., for stockholders and subscribers for an independent telephone exchange.

The Wolf River Telephone company is an applicant for a telephone exchange at Omro, Wis. A line is to be extended to Oshkosh from Omro.

The Home Telephone company at Marshalltown, Ia., has won a victory that gives a great deal of satisfaction. The Bell company's instruments were decided upon by the express companies at that point in preference to the Home company, but a visit to Chicago was made and such a strong statement of the case set forth that the order was rescinded and the old company's instruments ordered out. The old instruments have also been removed from the Chicago and Northwestern railway offices in Marshalltown.

Patrons of the Wisconsin Valley Telephone company in Chippewa Falls, Menomonie and other towns enjoyed a concert by telephone recently, the Scalchi company at Eau Claire furnishing the music.

A. W. Stone is arranging to establish a telephone exchange in Bird Island, Minn.

The Barron County Telephone company of Barron, Wis., decided to extend its line this spring to Almena and Turtle Lake.

The Mississippi Valley Telephone company of Keokuk, Ia., is an applicant for a franchise for a local exchange at Muscatine, Ia.

The Northwestern Telephone Exchange company is arranging to make a number of improvements and extensions in the vicinity of Grand Forks, N. D. A new line will be constructed to Crookston, Minn., and lines extended to Park River and Langdon. Northwood and Inkster, N. D., will also be connected.

The city of Neola, Ia., voted bonds for the construction of a municipal electric-light plant.

The street-railway company of Bute, Mont., proposes to change its West Side line to run on Arizona street, from Park to Broadway, on Broadway to Main, and on Main to Granite, thence west to the gulch. The change is favorably regarded and the council will probably give the desired permission.

The council of West Superior, Wis., has appointed a committee to secure plans and estimates of cost for a municipal electric-light plant. C.

People's Telephone Exchange, Knoxville, Tenn.

The peculiar form of the switchboard used in the People's Telephone Exchange at Knoxville, Tenn., which is shown in Fig. 1, will attract attention. It is made by the Swarts Switchboard and Electric company of that city, and is the invention of Henry J. Swarts. Another form embodying the same principle is shown in Fig 2. The special claim for this form of construction is that while all the advantages of a multiple board are gained, that system is not used. A 1,200-line exchange can be equipped so that every subscriber's jack will be within reach of any operator. This board has been in actual use two years, and it is claimed that the service of the Knoxville exchange compares favorably with that of any independent company in the country, especially in point of rapidity.

Telephone Legislation in New York.

[Special correspondence of the Western Electrician.]

Albany, March 3.—At a meeting of the Senate finance committe Senator Brush endeavored to have his telephone bill reported without a hearing, saying:

"The bill has been before the Legislature for years, and the members have a large store of information on the subject which can hardly be added to by any information outsiders might give now. The people are getting restless under the tyranny of the telephone monopoly. It is breeding a spirit of anarchy. It appears to me that this Legislature, knowing that the great majority of the people of the state want this bill passed, should pass it without further ado. It puts no illegitimate restrictions on the telephone companies. It allows them to earn a 10 per cent. dividend, which is all a railroad is allowed to earn under our laws. The only opposition to it lies in the fact that the company has been inflated so that a 10 per cent. dividend on the actual investment, including profits reinvested, would not be more than two or three per cent. on the public value of stock."

The senator's appeal was futile. A hearing was granted to-day.

New Telephone Company in New York.

The Knickerbocker Telephone and Telegraph company which was incorporated at Albany, N. Y., February 19th, with a capital of $7,500,000, will construct and operate telephone lines throughout New York and New Jersey. The directors are Samuel B. Lawrence, Francis P. Lowrey and Charles L. Horton of Manhattan borough, and John B. Summerfield, Henry M. Haviland, George S. Spencer and Henry F. Everdell of Brooklyn borough. The company paid into the state treasury an organization tax of $9,375.

The Telephone in Railroad Operation.

The Panhandle Railway company is putting in telephones at points where improvements are in progress and in this way furnishing means for facilitating the movement of trains without the expense of telegraph operators. Commenting upon this, the Railroad Review says: "This is only one of many cases in which the telephone is crowding out the telegraph, and we may expect many more such."

Married over the Telephone.

[From the Cleveland Plain Dealer.]

There is a general disposition among the leading editors of the nation to speak deprecatingly of the practice of getting married by telephone or telegraph. They claim that it robs a somewhat serious ceremony of its most sacred features, as it were, and that it adds a sensational glare to what should be a grave and decorous function. Aside from these good and sufficient reasons it may also be imagined that marriage lines pronounced over some telephones would scarcely redound to the moral advancement of the high contracting parties. There are telephones that would put a wire edge on the most promising honeymoon.

For instance, suppose a youth is detained in the city by extremely important business, and can't get to the house of his bride-to-be until after the hour announced for the ceremony. Everything is in readiness, however, the guests and the parson and the license are all waiting at one end of the line. What, then, could be simpler than to call the detained youth to the telephone and hurry through the service? It sounds easy, of course, but the youth may not find it so.

Here he is at the telephone.

"Ah, is that you, parson? Yes, all ready. Let her go. Eh, what's that? Yes, we're talking. Go on, parson. Yes, this is George McGoozle. You know my voice, don't you? Say, exchange, can't you stop that idiot from cutting in on us? Excuse me, parson, but there's some blooming chump whose wire must be crossed over ours, and who insists on talking the price of hogs to some other chap. Hello, there! Call off your hogs for half a minute, can't you? How's that? Say, what's your

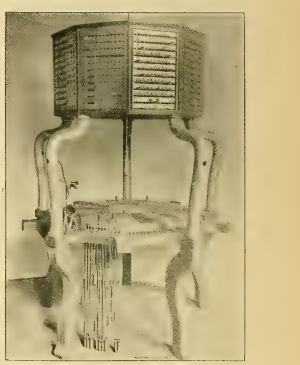


FIG. 2. PEOPLE'S TELEPHONE EXCHANGE, KNOXVILLE, TENN.

number? I'd like to drop around in the morning and level your face for you! Go on, parson. No, I ain't talking to you. Yes, I hear you now. Repeat what you say? Steam ahead. Hang it all, exchange! Exchange! Exchange! What in thunder is that horrible buzzing noise? Eh, a passing motor? How soon will the next one be along? Five minutes? Swing ahead, parson. Repeat? Oh, yes. (Mumbles away. I don't get some of it, but I s'pose it's all right. Eh? Of course I do! Every time. Yes-sir-ee! What? Is it all over? Who-o p! I'll see you later, parson. Oh, is that you, wife? Say, I'll just put a kiss into the receiver—can you hear it? There's that confounded hog man laughing! I'll look you up in the morning—eh? Of course I'll be home before morning. By-by, wife. (Rings off.) Whew! I'm glad it's over."

Telephone Enterprises Valuable Investments.

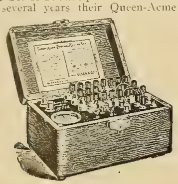
[From the Minneapolis correspondent of the Western Electrician.]

The Wausau, Wis., Telephone company at its annual meeting re-elected all the old board of directors. During the three years the system has been in operation $5,850 worth of stock has been sold and a plant worth $11,000 installed and paid for. Dividends aggregating 30 per cent. have been declared and paid, making the earnings of the company for three years 130 per cent. or 43 per cent. per annum. Telephone rentals have been reduced 30 per cent. for stores and and much more for residences. The company has built six rural toll lines and has a number of others in contemplation for the coming year.

Frank D. Jackson of Bartow, Fla., wants addresses of dealers in and manufacturers of telephone equipment.

Portable Testing Set.

The convenience and accuracy of a well-designed portable Wheatstone bridge recommend it above all other methods for general resistance measurements. It should be compact and complete, requiring no adjustment and having practical immunity from accident or derangement. The range of measurement should be wide and the accuracy as high as will be required in commercial work. Queen & Co. of Philadelphia have had on the market for several years their Queen-Acme portable



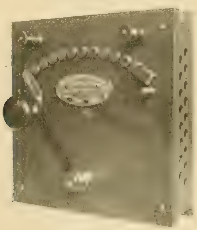
PORTABLE TESTING SET.

testing set, designed to meet the requirements mentioned. How well this result has been secured may be judged from the fact that they are supplying them to the telephone companies and electric-light stations of this country, South America, Canada, Russia and Japan. Their set is in use on all of the vessels of the United States Navy, being approved by the government for that purpose.

Recent improvements of such value have been made in the Queen-Acme as to warrant the manufacturers in calling attention to these advantages. The illustration shows the instrument in its new form. A most important improvement has been made in the galvanometer, whereby the sensibility has been increased six-fold, greatly extending its range of measurement and correspondingly adding to its accuracy. Another improvement has been an alteration in the construction of the galvanometer so as to enable it to withstand transportation without injury. The galvanometer is of the D'Arsonval type, dead-beat, requiring no adjustment previous to using, and unaffected by external magnetic fields or mechanical vibrations. As to the range of measurement, the theoretical limits are from .001 of an ohm to 11,110,000 ohms. Practically, the range is from .01 of an ohm to 5,000,000 ohms. In the case of the lower limit it gives a result accurate to one per cent. When measuring five megohms the accuracy is two per cent. For intermediate values the accuracy is much higher, being throughout most of the range nearly one-fifth of one per cent. Owing to the long galvanometer scale and the flexible arrangements of its connections, the range may be considerably extended beyond that already given. For example, a battery of high electromotive force and a direct-deflection method permits of insulation comparisons as high as 20 megohms. The coils are of special wire, carefully seasoned and adjusted to a considerably higher degree of accuracy than heretofore. By suitable connections the galvanometer or battery may be used independently of the rest of the set, or they may be used jointly in series with the rheostat.

Raster Rheostat.

The newly organized Raster Carbon Rheostat company proposes to utilize carbon compounds with



RASTER RHEOSTAT.

other secret compositions or alloys in the manufacture of resistance for various electrical purposes. The accompanying cut illustrates one of its safety spring catch motor starting rheostats. The officers of the company are: President and treasurer, E. O. Raster; vice president, Arthur Heis; secretary, August Schmatzer; electrical engineer, W. R. Garton. They are young and energetic, and are determined to make a success of their business, being much encouraged by the first few months' experience. The office of the company is located at No. 414 Ashland block, Chicago, and its factory is at 184-202 South Clinton street, Chicago.

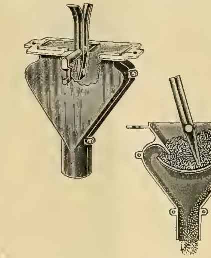
An Improved Sand-box.

The Ham sand-box illustrated herewith and sold by the Electric Appliance company of Chicago is based upon the theory that any box provided with a valve at its bottom is impracticable. If the valve be made tight enough to prevent the sand from sifting through, it will require great force to operate it, while if the valve be loose enough to work easily, it will allow the sand to sift around it. The company also claims that if a pebble gets into the valve slide it will hold it open so that the sand will run out of the box.

In the No. 3 Ham sand-box illustrated all parts are made of bronze metal. The box has an opening, under which is a curved shelf. The ends of the shelf extend beyond and above the opening in the box, so that the sand cannot escape by gravity. A paddle is reciprocated above the shelf, and the movement of the paddle forces the sand in each direction alternately over the ends of the shelf to the feed spout which leads to the car track. Above the paddle are two fingers which stir the sand. The connecting rod passes forward to the car platform, and is operated by a pin and bell-crank lever, or by a hand lever. The working parts are extremely simple and the motions direct. The strokes of the foot or hand may follow each other so rapidly as to practically secure a continuous but small stream of sand, a decided advantage in hill climbing. It can be easily seen that waste is impossible in this box, as the sand flows only when the lever is in motion, and the quantity of sand is regulated.

The sand-hopper inside of the car and directly over the sand-box may be made of any form desired. If the space under the seats is inclosed, a square soap box or any other cheap form of construction may be employed.

Small stones or other small substances will not interfere with the operation of this box, but will pass freely through it. In fact, the company recommends



AN IMPROVED SAND-BOX.

coarse in preference to fine sand, even if it contains gravel stones as large as peas, as it is less likely to pack in the box.

The manufacturers state that they have unsolicited testimonials favorable to the box, received from prominent railroad men.

Electrical Installation under Difficulties.

The far western part of the United States—that is, the part west of the Missouri River—is a country full of enterprise. Fancy a Russian, or even a German or British town of 1,500 inhabitants, ordering an electric-light plant which would have to be hauled over mountainous bridle paths for 150 miles from the nearest railway station before it reached its destination! Yet this is what the town of Lander, in Wyoming, had the courage to do, says a writer in Cassier's Magazine, each mule employed taking 12 days to make the round trip between Bitter Creek, on the Union Pacific railway, and the town whose progress was apparently impeded for want of the latest and most expensive means of artificial illumination. The town of Sheridan, also in Wyoming, had only 600 inhabitants and was 200 miles from the nearest railroad when it discovered that an electric-light plant was essential to a continuance of its self-respect. Accordingly the plant, packed in very small pieces, was hauled 200 miles, and Sheridan was happy. Since then this town has had a streak of luck, for the Burlington railway, pushing its way toward the Yellowstone River, has gone right through it, thereby increasing its population at a single bound from 600 to 1,000. Buffalo, another town in the same state, having 600 inhabitants, thought 44 miles a comparatively short distance to haul its electric-light plant.

In the adjoining state of Idaho, the important town of Lewiston, with 2,000 inhabitants, had its electric-light plant hauled on boats for 80 miles up the Snake River. Murray, with 700 population, had a 60-mile overland passage to accomplish, or about the same length that Silver City, with a hundred less population, hauled its electric-light plant. Turning now to places situated on the railways, it is found that Newcastle, Cambria, Rawlins, Rock Spring, Green River and Evanston, in Wyoming, and Pocatello and Idaho Falls, in Idaho, have each an electric-light plant, though the population of not a single one of these towns exceeds 300. Boise City, Idaho, as befits a town puffed up with 8,000 inhabitants, has not only an electric-light plant, but a system of trolley cars. Moreover, as some natural hot springs happen to be close to Boise City, the citizens heat their houses with the hot water from them, and even raise early spring vegetables by using the hot springs for irrigation purposes. The three small mining camps of Cœur D'Alene, Wallace and Wardner use electricity for lighting purposes all the year round, while their available water power is used to run the mills for stamping ore. But in winter, when the main water supply is frozen, the electric current is connected with the stamping mills, and lighting and power are furnished by a lavish expenditure of coal at $10 a ton.

Consolidated Car-heating Patent Sustained.

Both claims of J. H. McElroy's electrical heater patent No. 500,288 have been sustained. This patent is owned by the Consolidated Car-heating company of Albany, and the litigation was directed against the West End Street Railway company of Boston, which was equipped with electric car heaters by the American Electric Heating corporation, the latter company in reality defending the suit. Last summer Judge Putnam of the United States Circuit Court for the District of Massachusetts rendered a decision holding the American heater to be an infringing device and sustaining the second claim of the McElroy patent, but denying the first on the ground of its identity with the second. Both sides appealed the case, the Consolidated company to establish the first claim. The United States Circuit Court of Appeals for the First Circuit has now broadly sustained both claims of the patent. This decision is one of much importance to electric-railway companies and others using electric heaters.

CORRESPONDENCE.

New York Notes.

New York, March 1.—An interesting announcement is made in connection with the electrical exhibition to be held in Madison Square Garden in May. It has been decided that one or more evenings during the show shall be set apart for a telegraph tournament. This contest will undoubtedly be a great popular attraction, as well as of especial interest to the thousands of telegraph operators in town. The committee has secured the services of Mr. Fred Catlin, who is exceptionally well fitted to successfully conduct an affair of this magnitude. Mr. Catlin is termed "the father of telegraph tournaments," for, with one exception, he has managed every telegraphic contest which has been held in New York since 1866, when Mr. Pat Burns of Boston won the gold key, including the Bunnell key contest, in the Western Union building in 1884, which was won by Mr. W. L. Waugh; the Victor key contest, in the United Press rooms in 1885, won by Mr. J. W. Roloson, and the great national fast-sending tournament at Hardman Hall in 1890. Mr. James D. Reid, the "father of the telegraph," and well known to every operator the world over, has consented to act as chairman of the board of judges. The management will spare no efforts to make this feature of the exhibition a most attractive and successful one. The prizes will be liberal and the contests numerous, and there will be ample opportunity for the young talent which has come into the field since the last tournament of five years ago to show of what stuff it is composed. Mr. Catlin gives it as his opinion that the records will be beaten. The enterprise has the hearty support of the Telegraph Age.

The Holland submarine boat, which is electrically driven by storage batteries and an electric motor, excited a great deal of attention last week during the visit of the Spanish cruiser. Some impetuous people seemed to think that the new boat would most likely distinguish itself by an effort to blow up the foreign war vessel, and its movements were watched accordingly. However, nothing more exciting happened than a successful trial of the boat on Thursday. Mr. Holland, in his boat, was unconscious of the trouble he was causing. He caused the tug Erie to tow him into deep water near Kreischerville, Staten Island, and then he cast loose, and the Holland, after months of experiments, was left to her own devices. She sped along at a rate which gave the tug all she could do to keep near. Then the cap was screwed into the hatchway and the Holland disappeared. She went down about 20 feet, circled about a little and then came to the surface and floated steadily. During the submersion it is said that she lost only a foot of headway. Mr. Holland is reported as saying that he wants a few hard tests of the boat himself, and then he will invite the navy officers to look into her and take journeys under water. He is quite confident that the problem of submarine navigation is solved. He said the boat behaved even better than he expected. Engineer C. M. Morris, who was a little afraid of the new craft at first, was, after the trial, in a most confident frame of mind. "Goes like a fish and dives better than one," was the way he put it.

The Hudson Subway company of this city has been incorporated to construct and maintain subways or tunnels to hold pneumatic tubes, gas and water pipes

and telephone and telegraph wires and cables. The directors are T. F. Lennon, Thomas F. Farrell and Walton J. Aims. The capital stock is $5,000.

The Flushing Electric Light and Power company has certified to the secretary of state an increase of its capital stock from $100,000 to $250,000. The liabilities of the corporation are placed at $151,159.

It is announced that the Henry R. Worthington company of this city, the great power-pump manufacturer, will equip its extensive factory in Brooklyn with electric motors, if a preliminary trial, now undertaken, proves satisfactory.

The officers of the Brooklyn Elevated Railroad company have signed a contract with the officers of the Walker company to equip 150 cars with electric motors. A contract was entered into at the same time with the Sprague electric company to put the Sprague system of multiple control in operation in connection with the Walker motors. Trains on the Brooklyn bridge are already electrically equipped and the Brooklyn Elevated company will be enabled to run is cars on the bridge tracks with very little additional expense, after making the connection at the Brooklyn terminal. President Uhlman of the Brooklyn Elevated road says that many of the cars will be running over the bridge by June 1.

The first contract for the great power house of the Metropolitan Street Railway company has been awarded to the General Electric company. The contract includes five 5,000 horse power dynamos. The installation of these alone will make the plant the largest of its kind, constructed for traction purposes, in the world. The new power house will occupy a space of 201 by 279 feet. About one-half of the building will be given up to the coal bin, boilers and conveying machinery. There will be 87 boilers arranged in three tiers, each having a capacity of 400 horse power. There will be 11 engines of 4,000 nominal horse power, but having a maximum capacity of 6,600 horse power each. The generators, one of which will be connected direct to each engine, will be of the three-phase, 6,000-volt, alternating-current type. W. F. O.

Western New York.

Niagara Falls, March 1.—Recently receivers were appointed for Frank W. Hawley in the Supreme Court and in the City Court of New York. Mr. Hawley is well known in the electrical field for his connection with the Cataract General Electric company, which company holds a valuable franchise from New York state for operating canal boats by electricity. Justice Olcott appointed William H. Shepard receiver, on the application of Oliver M. Farrand, who has a judgment of $576 for jewelry. On the same day Justice Bishoff appointed John M. Shedd as receiver, on application of Charles L. Atterbury, a judgment creditor for $11,259. As grounds for appointing the receivers, it is stated that Mr. Hawley is a director in various companies.

Senator Lamy has introduced a bill in the New York Legislature providing that no street-railway company operating in the city of Buffalo shall hereafter charge more than four cents for a ride. The bill also provides that seven tickets shall be sold for a quarter and that the different companies shall give free transfers to each other's lines at all junction points.

The proposed electric road from Penn Yan to Geneva is thought to be nearly a sure thing. Franchises are likely to be asked for after the spring elections.

The advocates of the proposed extension of the Auburn City railroads west from the city limits to Cayuga Lake still have hopes that the plans will yet be carried into execution, and that Auburn, Seneca Falls, Waterloo and Geneva will be connected by a trolley line. Recently General L. S. Ebright of Akron, Ohio, and Wilson H. Pixley of the same place spent several days in Auburn. At a meeting of the Auburn Interurban Road company, General Ebright was elected to succeed V. S. Lord as one of the directors of the company, and at a later meeting the following-named gentlemen were chosen as a board of directors: George B. Turner, L. S. Ebright, George B. Longstreet, A. P. Rich, E. I. Edgecomb, George B. Leonard, George N. Cheny, Frederick T. Pierson and C. D. Beebe. The election of this board of directors is said to have been the result of an agreement made between General Ebright and Wilson H. Pixley, who had the largest financial interest in the Interurban road, and Clifford D. Beebe, the president of the Auburn City railroad. It is understood that the basis of the agreement is that the Auburn Interurban Electric Railroad company shall lease the lines of the Auburn City Railroad company. The directors have organized by electing these officers: President, George B. Leonard; vice-president, L. S. Ebright, secretary-treasurer, Frederick T. Pierson. Under the arrangement it is believed that the Interurban company will go ahead and build the road from Auburn to Cayuga, for which the Auburn and Western road was formed in 1896 by men prominent in the Auburn company. It is also thought that the line to Skaneateles will be built, the Interurban company having a franchise.

The Weedsport electric light plant, which was to have been in operation by March 1st, will not be ready by that time, on account of delay in the arrival of the necessary poles, which were missent.

A grand combination hotel and theater building is projected for Buffalo, in which Niagara power is to be used for light, heat and power. The plans are under consideration, George K. Birge being at the head of the movement.

The Buffalo General Electric company has decided to remodel its Court-street station, preparatory to placing therein the new machinery to light the city in connection with Niagara power. The old wooden roof will be replaced by a fireproof roof and the building made fireproof in every possible way. It is expected that the new installation will be ready for operation the latter part of the year.

A bill is now before the Legislature authorizing the enlargement of the International bridge crossing the Niagara River between Black Rock and Fort Erie, Ont., and it is said that if the bill becomes law it is proposed to build a trolley line from Buffalo into Canada. The idea is that such a road could be built down the Canadian side to the Falls to connect with the Niagara Falls Park and River railway, and then cross to the New York state side and return to Buffalo via the Ely line, or, if desired, continue on to Queenston and cross there to the Gorge line, over which the return to the Falls could be made. The trolley line would be built on the proposed upper deck of the bridge. O. E. D.

Notes from the South.

Knoxville, Tenn., February 28.—The Knoxville Street Railway company and the Knoxville Electric Light and Power company will expend in Greater Knoxville by October 1st the sum of $100,000 in extending their lines and tracks. The plant of the Knoxville Electric Light and Power company is one of the best equipped in the country. Major C. C. Howell, general manager of both companies, is now in the East negotiating for the sale of bonds.

Gainesville, Fla., has closed a contract with the electric-light company for lighting the streets. Fourteen arc lights and fifty 32 candle power incandescent lights will be used. The plant of the local company originally cost $20,000. It has a capacity of 600 incandescent and 100 arc lights.

Although the Muscogee Mills at Columbus, Ga., are driven by electric power rented from a power plant there, the Georgia factory at Athens is the first cotton mill in the state to generate and use its own electric power. The electric power is generated at a point about one mile below the factory building. There are 11,600 spindles, which will be run by electric power. W.

Northwestern Notations.

Minneapolis, March 1.—The mayor of Centralia, Wash., has refused to sign the lease of the electric-light plant to W. W. Canon. The council voted it by 5 to 1. It is understood that public sentiment is now against the measure.

Alderman Erickson of Sioux City, Ia., wants the matter of a municipal electric-light plant brought before the voters of the city.

The project of an independent electric company for Waterloo, Ia., received an impetus in the offer of a Cedar Falls man to take $6,000 worth of stock. By the terms of his offer, Waterloo capital to the amount of $10,000 is to be interested.

Mandan, N. D., has granted a franchise to C. E. V. Draper for electric lighting, reserving the right to purchase the plant at any time.

The project for an electric railway between Sheboygan, Wis., and Sheboygan Falls has been revived, and there is a strong probability that it will be constructed and put in operation this summer. The line will be an extension of the Sheboygan electric line, and will be built by John M. Seaman.

The option recently taken on the street-railway system of Appleton, Wis., has been allowed to expire, and it is supposed the proposed extensions to Fond du Lac will now be dropped.

The Twin City Rapid Transit company has accepted the ordinance passed by the St. Paul Council for changing the Selby avenue cable into electric, and proposes to begin work as soon as the frost is out of the ground.

John A. Hartlip, manager of the electric-light plant at Lake Mills, Ia., contemplates making a proposition to the council of Northwood, Ia., for a plant.

The local paper of Elroy, Wis., urges an electric plant be put in, to be operated in connection with the water-works.

The car barns of the Menominee (Mich.) Electric Light, Railway and Power company were burned, destroying 12 cars, with a total loss of $25,000. The company will borrow cars from Marinette until an equipment can be purchased.

The village of Gaylord, Minn., will vote on March 8th on the matter of a municipal electric-light plant.

Electrical engineers of the Twin Cities held their annual banquet in St. Paul recently. Between 30 and 40 were in attendance, and speeches were made by Morgan Brooks of the Electrical Engineering company, Minneapolis; Prof. George D. Shepardson of the State University, and others.

The electric light company of Jefferson, Wis., has made a proposition to the people of the town to sell the plant to a stock company, on the valuation of a disinterested committee. The company further offers to take a portion of the stock in the new company or not, just as may be thought best.

H. M. Vaughn has resigned as manager of the Electric Light and Power company of Newton, Ia., and is succeeded by C. E. Groesbeck of Grand Rapids, Mich.

The special election at Sac City, Ia., on the matter of granting a franchise for electric lighting to the Sac City Electric company was overwhelming in favor of the lights.

W. E. Caldwell & Co. have been granted a franchise at Bussey, Ia., for electric lighting.

It is reported that an electric railway will be constructed from the new town of Ferrodale, Ill., which Thompson McCosh, a millionaire of Burlington, Ia., will found, to Muscatine, Ia., via Oquawka, Keithsburg and New Boston.

Arthur Peabody has been granted a franchise at Baldwin, Wis., for an electric-light plant.

The electric-light company will have the new water wheels at Fergus Falls, Minn., in operation soon.

The Lakeside Street Railway company of Duluth, Minn., has sued the Duluth Street Railway company for $12,416.52, alleged to be due on profits on the Lakeside line, and also demands an accounting. It charges that the company refuses to turn over the profits, which have been covered up by fictitious charges of expense.

M. Shaw & Co. sued Fitch Gilbert in Eau Claire, Wis., for $23,672, claimed to be due from the National Electric Manufacturing company, which went to the wall several years ago. The plaintiff charges that the defendant made false representations to plaintiff to secure credit for the sum in question, when plaintiff was doubtful of the solvency of the National Electric Manufacturing company. It is said other suits will follow.

George Fisher of Remington, Ind., has made a proposition to the council of Lake City, Ia., to establish an electric light plant.

The Canyon Ferry dam near Helena, Mont., is expected to be put in operation furnishing electric power for Montana's capital city.

The council of Benson, Minn., contemplates putting in an electric fire-alarm, with an electric bell in the home of each fireman.

The electric-light and water-works plant at Wadena, Minn., is about completed. When it is finished the plant will be one of the best in the state.

The proposed street railway for Calumet, Mich., will be pushed in the spring. An electric belt line, 30 miles long, may be built within a year or two, to connect all the mining towns in the county.

The Marinette and Menominee Electrical company has been organized at Marinette, Wis., to develop electrical power from Chappe Rapids in the Menominee River. It will furnish power for street railway and for a paper mill. The plant will cost $150,000.

Canadian Intelligence.

Ottawa, February 28.—One of the commercial sensations of the year at Montreal was created when it became known that hereafter the Montreal Street Railway company would not only pay its dividends quarterly, but would increase them to 2½ per cent. quarterly. The stock of this electric railway is now quoted at 243¼, being an increase, since the announcement of the quarterly dividends, of 7½ points.

An electric horn, invented by Mr. A. Trudeau of this city, has just been placed upon the market. It is intended to be used in scholastic institutions in the dormitories for waking pupils, or as a fire alarm, or for any purpose where a whistle might be utilized and where there is an electric current available. The horns can be placed in different parts of a building and all set tooting at once by turning on the current.

A contract has just been entered into between the Public Works Department of Canada and the Ottawa Electric company, covering the lighting of all government buildings in Ottawa by electricity. At present there are some two thousand electric lights in the Parliament buildings alone. These are operated from an electric-light station belonging to the government. This station will now be closed and the circuits will be connected with the system of the local company. The remainder of the Parliament buildings as well as the departmental and other public buildings are lighted by gas, for which electricity will be substituted. The Ottawa company has five electric-light stations in the city, four of them using water as a motive power. Much unfavorable criticism has been expressed at the action of the department in passing over Canadian firms to purchase American electric fire appliances for the government buildings, but as the department considers the Worthington pumps to be the best in the world, these only will be accepted.

A bill passed the Ontario Legislature at its recent session which is regarded as being somewhat of an innovation. It provides that the city of St. Thomas, Ont., shall guarantee the street-railway company's bonds to the sum of $50,000, to enable the company to "electrify" its street-railway system. In the event of the company failing to keep up its payments on the bonds the city is permitted to take over the road and operate it. Hon. Mr. Gibson, commissioner of crown lands, in referring to the bill, stated that the provision for municipal operation was something that had never been introduced into the Legislature before, but he believed that, in the modern view, such powers were proper ones to bestow upon the municipality.

The Colonial Lighting Syndicate is said to be en-

deavoring to secure control of electric-light, gas and street-railway systems in Ontario. A recent issue of the Belleville (Ont.) Intelligencer says: "The proprietor of this paper has been in regular communication for many months with a Toronto firm, acting in the syndicate's interest, and we are given to understand that if the negotiations go through it is the intention of the syndicate to extend the road to Tweed, using heavy rails that will enable the Canadian Pacific railway to haul their cars to and from that town, a contract for that purpose to be entered into with the railway company. We also understand that Sir William Van Horne has agreed to give a certain sum of money toward the enterprise. The object of the syndicate is to secure a number of similar enterprises in Canada, operating them under one system, which it is now doing in Ceylon, where the representative, now in Canada, has been for 12 years."

Application will be made to the Dominion Parliament for an act to incorporate the North Shore Electric Railway company to construct a railway on the north shore of the St. Lawrence, starting from Three Rivers, in the province of Quebec, and through the district of Three Rivers and other districts in the province.

The Canadian Pacific railway is credited with the intention of building a telegraph line to Dawson City in the spring. It will probably be extended from Quesnelle, where the lines now end.

The British American Light and Power company is applying to Parliament for power to construct and operate by electricity or other power tramways to Dawson City, Fort Selkirk and other points in the Yukon and Northern British Columbia; also to operate heating and lighting systems.

The Dechenes Electric Light company of Dechenes Mills, Que., is having plans prepared for the construction of dams at Dechenes Rapids, intended to furnish 3,000 horse power. A new power house will also be erected, the contract for which will be let at an early date.

An electric railway between Ottawa and Metcalf is being advocated. The distance is about 20 miles, and the country through which such a road would run is quite level, and would necessitate no great engineering feats to construct the road. One great drawback is the lack of water power.

Application will be made to the Dominion Parliament for an act to incorporate the North Shore a company to construct a railway by electricity or other power between London, Ont., and a point in or near the village of Lucan, and from Lucan to a point in or near Centralia, in the township of Stephen, in the county of Huron, to a point in or near Grand Bend on Lake Huron; also with power to construct and operate telegraph and telephone lines, to take and use water for generating power, and to transmit and dispose of the power derived therefrom; to build, acquire and operate steam and other vessels, and all necessary wharves and docks.

A. V. W.

PERSONAL.

Prof. R. B. Owens now holds the position of director of the reorganized Bureau of Electricity at the Trans-Mississippi and International Exposition at Omaha.

Among recent electrical visitors to Chicago were William H. Hornsberger of Aurora, Ill., T. H. Graham of Virden, Ill., John S. Maurer of Fostoria, O., and Frank De Ronde of New York.

Charles W. Bartlett, general manager of the Mutual Telephone company of Des Moines, Iowa, is in Chicago. Mr. Bartlett directs the operations of a co-operative independent telephone company, which is proving very successful. He reports that his men can hardly keep up with the work of placing instruments for new subscribers.

Dennis Doren, the general superintendent of construction for the Western Union Telegraph company, is dead. Mr. Doren was one of the ante-bellum telegraphers and was also a military telegrapher during the war, when he made a fine record. Mr. Doren was very well known in telegraphic circles and highly esteemed. He was 68 years of age.

Hugh M Matheson, who died recently, was interested in the house of Matheson & Co. since the foundation of the firm in 1848, and for some years had been its active head. He was chairman of the Rio Tinto company for many years, and during recent years helped to manage the Mountain Copper company of California and the Electrical Copper company in London One of his last ventures in connection with American mining was to acquire an interest in copper properties in the Pyramid district in the East Kootenay division of British Columbia.

ELECTRIC LIGHTING.

Charles Williamson of Stuttgart, Ark., has secured an exclusive 30-year franchise for electric-light and water works service in that place. He will install a small plant at once

George F. Lamb, who has won the contract for furnishing Albion, N. Y., with fifty 2,000 candle power arc lamps every night, moonlight schedule, until 1 a. m., at $62 per year, states that as soon as spring opens his company will commence the erection of a power house, set poles and string wires for the purpose of carrying out the contract. The stock in the present plant is owned by the heirs of the late Hon. E. K. Hart and the late William G. Swan and others residing in Albion, composing the company which first furnished Albion with electricity.

The newly organized People's Electric Light and Power company of Crestline, O., has a 10-year contract for operation in that town. It will erect a station and install a complete equipment. The Cornman company of Cleveland has the contract for the electrical apparatus.

The aldermanic committee on electric-light plant at Atlanta, Ga., has recommended that the City Council employ a competent engineer, appropriating not more than $1,000 to investigate and report on the cost of the city erecting and operating its own electric-lighting system.

A certificate of incorporation of the Westchester (N. Y.) Gas and Electric company, with a capital stock of $300,000, has been filed. The company is formed to carry on the manufacture of gas and electric light in the towns and villages of Rye, Port Chester, Mamaroneck, Larchmont, New Rochelle, Harrison and Scarsdale, N. Y., and Greenwich, Conn. James M. Pendleton of Westerly, R. I.; George V. Foster of New York; Arthur L. Chester of Westerly, R. I.; Wallace Hackett of Portsmouth, N. H.; Herbert T. Jennings of Mount Vernon, Paul Armitage of Bay Shore, N. Y., and Henry D. Donnelly of Brooklyn are the directors.

The new Parkersburg (W. Va.) Gas, Electric Light and Street Railway company is a consolidation of the old Parkersburg Gas company, the Parkersburg Electric Light company and the Parkersburg City and Suburban Street Railway company. The old gas and electric companies had been in existence for several years. The railway company had been recently organized, and had just begun the construction of a road. It contemplated covering only the streets of the city and the adjacent suburban villages, making a trackage of about eight miles. The new management expects to have the entire road completed and running by the first of June.

Electric headlights for locomotives are meeting with increasing favor. George Rommel, the master mechanic of the Wilmington and Northern railroad, writes to the Railway Age to give this testimony: "We have had them in use for the past six years, and they have been entirely satisfactory. They are not only the best headlights, but the current generated by the dynamo can be used for lighting trains. We have experimented with this for some time and have had our mail car No. 12 lit up for some time and have obtained excellent results. We have six 16 candle power incandescent lamps in this car. In our first experiments we put 14 lamps on a board and attached them to main wire, and they all lit up brilliantly, with no perceptible change in the headlight. We feel confident that we can attach twice that number, and will equip our trains with them as soon as we can get the necessary couplers. The electric headlight has come to stay."

ELECTRIC RAILWAYS.

The Chicago City Railway company has asked the City Council for permission to build 14 miles of new overhead trolley-car lines, mostly in Hyde Park.

An electric line 30 miles in length will soon be built by the Obion and Tiptonville Rapid Transit company, connecting Obion, Tenn., with Tiptonville. W. B. Southgate of Nashville has been engaged to locate the line.

Percival Steele of Chicago and others have secured a franchise to build an electric railroad in Vicksburg, Miss. At least four miles are to be completed during the present year and work is to be begun within the next five months.

A new electric railroad is to be constructed to connect Charleston, S. C., with Mt. Pleasant, Sullivan's Island and Long Island. The company will be known as the Charleston and Seashore Railroad company, and will have a capital of $400,000 and a like amount of bonded debt.

An effort is being made to amend the act governing the Washington and Marlboro Electric Railway company, so that it may be enabled to extend its lines into the District of Columbia, the work of extension to be completed within one year after the passage of the bill.

The Fairmont Electric Railway company has been chartered for the purpose of operating an electric street railway in Fairmont, W. Va., and through the counties of Marion, Monongalia and Harrison. The incorporators are John B. Crane, Charles E. Manley, A. Howard Fleming and others.

It is reported that the Portsmouth (Va.) Pig Point and Newport News Railroad company is about to commence work on its electric line between Portsmouth and Pig Point. A ferry will be used in connection with the road to Newport News. Henry Kirn and R. H. Norfleet are in charge of the construction.

The Cincinnati Street Railway company has closed a contract with the General Electric company amounting, it is said, to over $100,000. It covers the necessary electrical apparatus to enable the Cincinnati company to change over that portion of its system now driven by cable, the Walnut Hills line, to an electric system. The Boston elevated railway has also placed a contract with the same company for electrical apparatus amounting to the same sum.

The new Electric Light and Street Railway company of Parkersburg, W. Va., has purchased the Park City street railway for $20,000. All the old bonds have been taken up and paid for. The new company has surveyed and mapped out all its lines and will begin work on the electric system throughout the city and suburbs immediately.

All the street-railway property and franchises in Detroit are now, it is said, owned by the interests represented by Tom L. Johnson of Cleveland and Albert Pack of Detroit. These men have for some time been at the head of the Detroit Railway company and the Citizens' Street Railway company. On March 1st they filed articles of association of the Detroit, Fort Wayne and Belle Isle railway, the successor of the Fort Wayne and Belle Isle company, the purchase of which for $700,000 they have concluded. The new company has a capital stock of $1,200,000, which, it is asserted, represents the actual value of the property and franchise, the capitalization of the old company being far too small. The stockholders of all three companies are now practically the same.

A scheme or system of rapid transit for the city of Paris was adopted recently, after several years' study of the needs and cost of such an improvement. The project contemplates a number of connecting railroads, to be operated by electricity, and it is expected that a portion of the line will be in operation some time next year. There will be seven distinct routes, with a number of crossing or connecting lines, forming a network that should afford excellent facilities for intercommunication to various parts of the city. The total length will be 41 miles, of which 25 will be underground, seven in open cutting, and about the same on viaduct. The motor cars to be used will seat 44 passengers and weigh 20,000 pounds, exclusive of passengers. It is proposed to run trains of four cars, only one of them being a motor car (which will probably receive current for its operation from a third rail), and the other three of practically the same size and seating capacity, but weighing only 13,000 pounds. For the speed and frequency of the trains as proposed, it is calculated that about 25,000 horse power will be required. The estimated cost of road and equipment is to be $36,000,000.

TELEPHONE.

The Mountain Telephone company of Harlan, Ky., has been incorporated, with H. C. Clay as president; Prof. W. C. Clemens, secretary and treasurer, and John B. Hurst, general manager.

The Southern Bell Telephone company will make extensive improvements to its building and exchange in Birmingham, Ala., at an expenditure of possibly $20,000.

The Northwestern Telephone Manufacturing company of Milwaukee, Wis., says it is at present overrun with orders for telephonic apparatus, and has found it necessary to order additional machinery to enable it to cope with the orders now at hand.

POWER TRANSMISSION.

It is stated that a syndicate of New York capitalists has formed a scheme for obtaining control of the water power of the Housatonic River and using it to drive an electric plant two miles above Shelton, Conn., to furnish power to the factories and trolley roads of all of the cities and towns in the state west of the Connecticut River. It is understood that Standard Oil men are leaders in the enterprise. James C. De Long of New York, an agent of the company, has been in Waterbury in consultation with Superintendent Sewell of the Waterbury Traction company and with the heads of the principal factories in that city and in Bristol, Hartford, Meriden, New Britain and Berlin. A short distance above Shelton is the famous Housatonic dam. The river at this place is about 200 yards wide, and the dam has a height of 28 feet. From it leads a canal that furnishes water to a number of factories in Shelton.

A recently completed power transmission plant is that of the Delta (Pa.) Electric Power company, which transmits 450 horse power from Gartridge Falls on Muddy Creek to the town of Delta, York County, Pa., a distance of five miles. At the falls there is a dam 41 feet high and 120 feet wide, and the water is conducted to a stone power house, in which are installed a pair of turbines and a 350-kilowatt generator. Twenty-four inch McCormick turbines, made by the S. Morgan Smith company of York, Pa., give 560 horse power at 400 revolutions. The water power at the dam is estimated at 1,000 horse power at low water. The turbines are directly coupled to the generator, which is of the Stanley two-phase type and designed for an output of 5,000 volts pressure. The current is taken over a substantial aerial line of No. 4 wire to Delta, where there is a sub station with five step-down transformers. One transformer of 40 kilowatts reduces the

voltage to 1,000 for the Delta Electric Light company, and this is further reduced to 110 volts at points of consumption. Four transformers in the sub-station are for power purposes, and these reduce the potential to about 450 volts for the operation of Westinghouse two-phase motors. One motor drives the press of the Delta Herald and Times, and that paper has published a very good account of the plant.

ELECTRICAL SECURITIES.

The Edison Electric Illuminating company of New York reports gross earnings for January of $298,307, an increase of $58,008 as compared with the same month last year, and net $165,389, an increase of $28,845.

The Edison Electric Illuminating company of Brooklyn reports gross earnings for January of $89,381, an increase of $5,633, as compared with the same month of last year, and net $44,002, an increase of $1,605.

The annual report of the Columbus, O., Street Railway company shows a surplus of $4,293 in the year's business after paying $286,874 in operating expenses, $200,151 in fixed charges and $120,000 in dividends. The gross earnings were $605,921.

The shareholders of the Coney Island and Brooklyn Railroad company have voted to increase the capital stock of the company from $1,000,000 to $2,000,000. Negotiations are under way for the complete consolidation of the road with the Brooklyn City and Newtown railroad, hence the increase in the capital stock.

The last quarterly statement of the Metropolitan Street Railway company of New York city has been filed with the State Railroad Commission. It shows a net increase in earnings as compared with the corresponding quarter of the preceding year of $188,484. The report shows: Gross earnings, $2,383,458; operating expenses, $1,208,769; net from operation, $1,174,688; other income, $150,918; gross income, $1,325,607; fixed charges, $789,006; net income, $536,600. The net income for the same quarter in 1896 was $418,116. The general balance sheet shows cash on hand of $1,163,807, and a profit and loss (surplus) of $1,737,198. There was earned on the stock in the quarter 1.785 per cent., against 1.36 per cent. in 1896 and 1.19 per cent. in 1895.

MISCELLANEOUS.

Frank C. Perkins, 126 Erie County Bank building, Buffalo, N. Y., is one of the patentees of a new automatic electric switch and circuit breaker. He wishes to correspond with switch and cut-out manufacturers who can make the new device in thousand lots.

Sealed proposals are being invited until March 24. 1898, for electric lighting and power installation at Plum Island, N. Y. Specifications and blank forms of proposals can be obtained upon application to Major Smith S. Leach, United States engineer, New London, Conn.

The city administration has caused to be introduced in the City Council of Chicago an ordinance requiring a fee of $2 for every permit for electrical line construction—overhead or underground—in the city. The ordinance relates to the setting of poles, laying of conduits, stringing of wires and the like, and not to the wiring of buildings or the installation of plants. It is intended to recompense the city for the inspector's investigation. The ordinance was referred to the finance committee.

The naval appropriation bill in the House of Representatives contains the following items of interest to the electrical industry: An addition to the electric-light system at the Brooklyn navy yard, $15,000; steam generator for heating purposes and electric plant at the League Island navy yard, $5,500; for improvement of the electric plant at the Washington navy yard, $10,000; for enlargement of electric plant and concentration of steam at the Norfolk navy yard, $20,000, extension of the electric-light system at the Mare Island navy yard, $15,000; for electric plant for Puget Sound naval station, $9,800; for building a conduit for underground service for wires, etc, and for other purposes, at the naval observatory, $15,000. The bill carries a total appropriation of $31,918,626 55.

TRADE NEWS.

The Cabinet Manufacturing company, formerly of Ashtabula, O., is now installed in its new and modern plant at Steubenville, O. Telephone woodwork is the specialty of this company.

The eastern friends of Mr. John R. Cole of San Francisco, general sales agent for the Pacific Coast for the New York Insulated Wire company, enjoyed a renewal of his acquaintance last week.

Manager of Sales B. C. Kenyon of the New York office of the Diehl Manufacturing company, Elizabethport, N. J., paid a visit to Chicago last week. Mr. Kenyon has been on an extensive trip clear through to the Pacific Coast, and is now on his way back to New York. He is greatly pleased with the sale of Diehl fans and lamps. In fact, he stated that he had secured, as he put it, "several Klondike orders," one of which was so large that it really astonished him.

The Stromberg-Carlson Telephone Manufacturing company of Chicago is reporting a steady, increasing demand for telephones for mines. The equipment for this purpose is protected against dampness by saturating the principal parts in a specially prepared compound.

A. A. Kent, manager of the Kent Electric Manufacturing company of Worcester, Mass., writes that his factory, with a stock of motors, was recently destroyed by fire. The company set to work energetically to make good its loss, and expects to be back where it was by next week.

A fine book is issued by the Cambria Iron company of Philadelphia, giving useful information, with full-size plates of steel girder rails for street-railway use. Data of other materials for track construction are also given, and the work should form a valuable and welcome addition to the engineer's library.

The Davis & Egan Machine Tool company of Cincinnati, O., has just received an order from its Copenhagen office for 11 machines, including lathes, milling machines, drill presses, screw machines, etc. It also has received an order for several lathes from St. Petersburg, Russia, and an order for three machines from Belgium.

Several new publications of the Western Electric company will interest the electric-light man. One is a well-executed bulletin of arc-lighting dynamos and others show the lamp parts of various types of arc lamps. The company also calls attention to its improved '98 desk fans, Tuerk alternating-current ceiling fans, Victor split insulators and swinging tree insulators.

Those engaged in telephone work who may be seeking a little reference book of general information can get a work of this character from the Farr Telephone and Construction Supply company of Chicago. The Farr company is prepared to furnish anything needed in the telephone and general construction line, and has by its promptness and general reliability earned an excellent reputation.

At a recent meeting of the stockholders of the Star Electric company of Binghamton, N. Y., the following-named directors were elected: George S. Beach, to hold office until first Tuesday in May, 1901, C. E. Beach (1900), H. W. Doughty, (1899), S. H. Chase (1898). At the adjourned annual meeting of the directors on February 16th, the following-named officers were elected: President, George S. Beach; secretary and general manager, C. E. Beach; treasurer, H. W. Doughty.

A. L. Ide & Sons, the engine-building firm of Springfield, Ill., issues the following self-explanatory notice: "The Hon. William J. Allen, judge of the Circuit Court of the United States at Springfield, Ill., handed down a decision in the case of Addie F. Ide et al., executors, against Chuse et al., on December 21st, sustaining the validity of the following patents: No. 308,498, for steam-engine governors, granted November 25, 1884, to Albert L. Ide; No. 321,726, for steam-engine cross-head lubricators, granted July 7, 1885, to Albert L. Ide; No. 396,209, for engine frames, granted January 15, 1889, to Albert L. Ide; No. 400,682, for lubricating device for steam engines, granted April 2, 1889, to Albert L. Ide. These patents cover the governor, engine frame, cross-head lubricator and self-oiling system which has become known to the public in connection with the Ideal engine. Manufacturers and users of engines embodying the features covered by these patents are notified that they will be held to account for infringement."

Visitors to the Chicago office of the Westinghouse Electric and Manufacturing company note a pleasing transformation in the offices in the New York Life building. The space has been divided into a larger number of offices, and the whole suite has been rearranged and handsomely decorated. Manager Coster and his energetic assistants are as active as their spick-and-span surroundings indicate. They report business as booming since the first of the year; in fact, last month was one of the most successful in the history of the office. A number of important contracts, some of them of exceptional interest, have been closed during this period. The Anglo-Swiss Condensed Milk company has ordered a large factory transmission plant for its establishment at Dixon, Ill. There will be two 120-kilowatt three-phase generators supplying 440-volt current at 7,200 alternations to 20 three-phase motors ranging in size from one to 20 horse power. These motors will be belted to shafting driving the machinery used in condensed-milk manufacture. The Glucose Sugar Refining company has signed a contract for two 120-kilowatt two-phase generators, to be installed in the Chicago factory of the company, to furnish current for lighting and motors. Another recent customer is the Western Cottage Organ company of Ottawa, Ill., which has placed its order for one 75-kilowatt two-phase generator and a 50 horse power motor of the same type. This plant will be water-driven and will include a four-mile transmission line between the power house and the factory. In direct-current apparatus the company's Chicago hustlers have been no less successful. A big plant has been sold to Deere & Co., the eminent firm of plowmakers of Moline, Ill. It comprises four shunt-wound, 500-volt, multipolar, 125 horse power motors and three motors of the same design but of 150 horse power each. The switchboard is included in the contract, but the current is supplied from the water-power plant at Moline. The United Alkali company of Bay City, Mich., has also placed an order for two direct-current generators to be direct-connected to Allis engines. These are multipolar machines of exceptional size and will be driven at 80 revolutions a minute. The current from them will be used for electrolytic work. Two direct-current generators of 225 kilowatts and 575 volts will be supplied to the Detroit, Ypsilanti and Ann Arbor Railway company; also two 125-kilowatt motor-driven boosters and 10 quadruple (four 50 horse power motors) car equipments. The generators in this plant are directly connected to Westinghouse engines and will operate at 250 revolutions.

BUSINESS.

The Berlin Iron Bridge company of East Berlin, Conn., is building a new boiler-house roof for the Coe Brass Manufacturing company at Ansonia, Conn.

On account of the great demand for engines for electric light and power purposes, the works of the Ball Engine company, Erie, Pa., builder of the Ball engine, have been operated night and day since September last.

An exceptionally interesting catalogue is that of Baker & Co. of Newark, N. J., gold, silver and platinum refiners. The book is principally devoted to data concerning platinum, which has many uses in electrical applications. Several valuable tables are given in the back of the book.

A booklet issued by the International Correspondence School of Scranton, Pa., gives endorsements of the steam engineering courses by 88 students. The school is prepared to give thorough and practical instruction wherever written or printed matter can be sent by mail.

"Shade Lamps" is the title of a dainty little catalogue just issued by the Electric Appliance company, covering its special lines of Espersen, Klemm and Dale electric portable and shade lamps. It is a valuable catalogue for any user or dealer in these goods, and will be sent on application.

The Mason Electric Equipment company of Chicago has just closed, through Manager E. R. Mason, a contract with C. E. Loss & Co. of Chicago for the six-mile extension of the Bluff City electric railway. This road runs from Waukegan, Ill., to Evanston. The entire overhead equipment was furnished by the Mason company.

J. Lang & Co. of 44 Michigan street, Chicago, manufacture both steam and electrical specialties, as their catalogue shows. They call attention to their special cast metal, which has a tested conductivity of 60 per cent. of pure, hard-drawn copper. They use this metal for the bases of their switches, for all lugs, connections, etc., in fact wherever carrying capacity is needed in castings.

The Ward Leonard Electric company has just issued a new price-list on circuit breakers, much less than the previous one, while the same discounts apply as before. The space occupied by apparatus on a switchboard is often a very important consideration. It is to be noted that the Ward Leonard company has designed its circuit breaker to occupy a minimum space without sacrificing material.

The Bristol and Plainville Tramway company is erecting near Plainville, Conn., a new substantial steel bridge, having a span of about 90 feet. The bridge has been designed with the view of being a permanent structure, well able to take care of the increasing and heavy traffic of the road. It has been furnished and is now being erected by the Berlin Iron Bridge company of East Berlin, Conn.

The Western Electric company has recently issued a bulletin descriptive of the Lakon transformer, which is made for long-distance transmission, for the ordinary 1,000 and 2,000-volt primary and 110 and 50-volt secondary, for three-wire system and for arc-light transmission. The transformers are oil-insulated and can be run either as dry transformers or oil-insulated transformers. The Laken transformers have no joints on the top or sides, the only joint being on the bottom, thus making the case thoroughly weatherproof without the use of cement or other material to fill up the cracks. The larger sizes are placed in either an open case for inside use or in weatherproof case for outside use.

The Pennsylvania Line has placed in service on its night trains between Chicago and Cincinnati Pullman compartment cars, thus improving its already excellent accommodations between Chicago and the Ohio River. For space apply to ticket agents Pennsylvania Lines, No. 248 Clark street, Auditorium

Hotel, No. 221 Michigan avenue, or Union Passenger Station, Canal and Adams streets, Chicago.

M. C. Henry & Co. of New York city are enlarging their plant and making some extensive improvements. Their new steel stone shed, which is about 50 feet wide, is to be extended about 70 feet in length. The metal work, which consists of the steel framework of the building, the covering upon the roof and sides, and the metal runway for traveling crane, is being furnished and erected by the Berlin Iron Bridge company of East Berlin, Conn.

The Western Electric company is at present recommending an electric spud as a serviceable construction tool. This spud is in the nature of a digging bar provided at one end with a braid of open-hearth crucible mining steel and on the upper end with an iron tamper, thus combining a digging bar and a tamping bar in one tool. The length of the spud is nine feet, and it digs three times as fast as an ordinary bar and is only half as heavy.

The complete wiring system, as established and standardized by the Interior Conduit and Installation company, will be installed exclusively in the new Park Row building, New York, said to be the largest office building in the world. Some 250,000 feet of interior conduit will be used in the installation, which will be made by the New York Electric Equipment company. The Sprague high-speed vertical electric elevators will also be used in this building.

The business of the Mansfield Tempered Copper company of Mansfield, O., has increased so rapidly during the last year that it has been found necessary to build an addition that will more than triple the capacity of the works. Among other large orders recently received for this company's tempered commutator bars have been several from England, where they are finding a ready sale. This company has now one of the best equipped factories in the country, with every facility for turning out large orders on short notice.

The Mica Insulator company of 218 Water street, New York, 117-119 Lake street, Chicago, and 12 Camomile street, London, reports a heavy increase in the volume of business. Many of the large manufacturers are using its Micanite segments exclusively in the construction of generators and motors. The company has made many valuable improvements in its well-known insulation, Micanite, and is turning out a fine commutator segment. It will be pleased to send a set of segments for any of the smaller machines, as samples, to electrical manufacturers or repair concerns who may make application. Its M-I-C friction tape and Empire cloth are meeting with a large sale. They are used for the winding of fields and armature coils.

Announcement is made of the following changes in management of the Wagner Electric Manufacturing company: S. B. Pike, secretary of the Missouri Edison Electric company, assumed general management of the business. He will be seconded by W. O. Layman as assistant general manager, who will take personal direction of the details of the business in all matters of an executive nature. Eugene H. Abadie will devote his entire time and efforts to the sale of the company's products, and Ferd Schwedtmann, who has so ably conducted the design and manufacture since the company's inception in 1892, will continue as superintendent of the manufacturing department. H. A. Wagner, being one of the board of directors, will continue his active interest in an advisory capacity.

The new catalogue of the Safety Insulated Wire and Cable company of 225 West Twenty-eighth street, New York, is a fine piece of advertising literature. It is evident the intention of the Safety company was to depart from wire-catalogue traditions, and create something that was unique and pleasing as well as instructive. That the company has succeeded in so doing will be the opinion of everyone who receives a copy of this excellent book. As it will doubtless be widely distributed, a description in detail is unnecessary. The back cover, however, is so unusual that it deserves special mention. It is a photograph in half-tone of a reel of Safety wire, showing reel, wire and shipping tag. The effect is very realistic. The half-tone cuts of wire and buildings throughout this book are of the first order.

Although a large number of series candelabra lamps is still in use a growing tendency exists to employ these lamps in multiple on ordinary circuits, with the result that the wiring of fixtures is much simplified, and the renewal of burned-out lamps rendered a much easier task. A full line of multiple candelabara lamps as well as series lamps is now made by the Edison Decorative and Miniature Lamp Department, which has just issued a handsomely illustrated catalogue in which all the styles of series and multiple candelabra lamps, multiple sign lamps, series decorative lamps, and lamps for special uses, such as bicycle, telephone, dental, surgical lamps and many others, are described. The department has also illustrated in this little work a complete line of receptacles and sockets for candelabra and miniature lamps. The catalogue is of interest not only to all central-station managers and dealers, but also to general customers, whether experimenter, physician or others using or likely to use lamps of this character. The catalogue may be obtained from the Edison Decorative and Miniature Lamp Department, General Electric company, Harrison, N. J.

ILLUSTRATED ELECTRICAL PATENT RECORD.

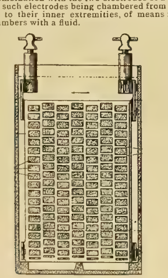
Issued February 22, 1898

599,315. Secondary Battery. Walter A. Crowdus, Chicago, Ill. Application filed January 25, 1897.

The process of forming the negative elements of spongy lead for use in secondary batteries consists in immersing plates coated with lead oxide in a solution of sulphate of zinc and sulphuric acid, and then passing a current through the solution and to the plates.

599,316. Electric Igniter for Gas Engines. Fitz E. Culver, Chicago, Ill. Application filed February 15, 1897.

The combination with the two electrodes of a gas-engine sparker, such electrodes being chambered from their outer portions to their inner extremities, of means for serving such chambers with a fluid.



NO. 599,315.

599,322. Individual Telephone Call. Thomas C. Drake, Malta, Ohio. Application filed July 2, 1894.

A selecting system is arranged to have each subscriber call any other subscriber without the intervention of the central office, comprising the combination of a line, a series of selecting devices thereon, step by step mechanism for operating the same, restoring mechanism for restoring the step-by-step mechanism to a position of unison, means operated by a current of given strength to operate the step by step mechanism, and means operated by a current of greater strength to operate the restoring mechanism.

599,344. Electric-railway System. John M. Murphy, Torrington, Conn. Application filed September 24, 1897.

An electric magnetic switch mechanism comprises a magnet having independent inner and outer windings, the outer winding having a lead connected with the sectional conductor, the inner winding having a lead connected with such conductor and having a switch in such inner winding lead, the yielding contacts connected respectively with the feeder wire and the outer winding of the magnet, and the plunger having a bridge piece to engage the contacts, and having means for breaking the switch in the inner winding lead.

599,346. Electric Wire-holding Appliance. Hugh A. McCoy, [illegible]. Application filed September [illegible].

A wire holding device is described, consisting of fingers pivoted to each other, provided with means for securing the same to a support and with means for holding the line wire consisting of openings [illegible] jaws in the fingers, the fingers being held open by a spring and adapted to be depressed by the weight of the line wire and to grip the same.

599,351. Electric Resistance Conductor. Henry G. O'Neill, Brookline, Mass. Application filed January 4, 1897.

A resistance conductor for converting electrical energy into heat energy, consisting of an oxide compound cast in the form of a rod or filament, having metallic terminal connections attached to each end thereof.

599,352. Electric Resistance Conductor. Henry G. O'Neill, Brookline, and Horace B. Gale, Boston, Mass. Application filed January 4, 1897.

In an electric conducting device there is the combination with a non-conductive support of a layer or film of conductive oxide applied to the support while in a fused state.

599,354. Electric Igniter for Explosive Engines. Hubert F. Probert, Chicago, Ill. Application filed April 8, 1897.

A rocker shaft moves one electrode against the other and causes the necessary spark.

599,393. Trolley for Electric Railways. Edward K. Landis, Philadelphia, Pa. Application filed March 5, 1897.

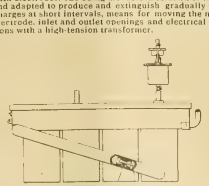
The current-collector is adapted to engage a conducting wire with a pivoted device having a wing on each side of the current-collector, each wing extending backwardly from its pivotal attachment to a point adjacent to the extremity of the current-collector, thence backwardly and obliquely, and thence forwardly toward its free end.

599,405. Electric Battery. Charles P. Shrewsbury, London, and John L. Dobell, Modbury, England. Application filed December 24, 1895.

This electric generator consists of a metallic cell containing an electrolyte, a chamber therein, a pipe leading from the chamber into the electrolyte, and suitable means for heating the metallic cell and keeping the electrolyte in a fused state.

599,455. Apparatus for Producing Ozone. Marius Otto, Paris, France. Application filed June 15, 1897.

The apparatus described comprises a shell or casing with electrodes, one being movable in relation to the other and adapted to produce and extinguish gradually the discharges at short intervals, means for moving the movable electrode, inlet and outlet openings and electrical connections with a high-tension transformer.



NO. 599,405.

599,480. Electric Arc Lamp. Orville B. Skinner and George M. Bacon, Cleveland, Ohio. Application filed August 27, 1897.

Provision is made in an arc lamp for an electro magnet horizontally disposed, and having poles with inclined faces, an armature outside the coil and parallel therewith, having inclined faces corresponding to those of the magnet poles, a carbon-holder depending from the armature, a spring retaining the carbon in the holder, a stop limiting the play of the armature and a trip adapted to release the spring.

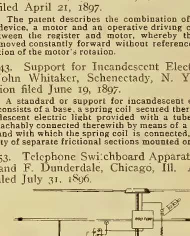
599,508. Driving Gear for Electric Meters. George A. Le Fevre, New York, N. Y. Application filed April 21, 1897.

The patent describes the combination of a registering device, a motor and an operative driving connection between the register and motor, whereby the register is moved constantly forward without reference to the direction of the motor's rotation.

599,543. Support for Incandescent Electric Lights. John Whitaker, Schenectady, N. Y. Application filed June 19, 1897.

A standard or support for incandescent electric lights consists of a base, a spring coil secured thereto, an incandescent electric light provided with a tube which is detachably connected therewith by means of a screw thread, and with which the spring coil is connected, and a plurality of separate frictional sections mounted on the coil.

599,553. Telephone Switchboard Apparatus. Cleaveland F. Dunderdale, Chicago, Ill. Application filed July 31, 1896.



NO. 599,344.

This switchboard comprises a hinged lever connected with the subscriber's line and constituting a line terminal which has a movement in more than one direction, and terminals for auxiliary circuits adjacent to the lever, together with a spring normally holding the lever in a position against one of the terminals.

599,560. Paper-perforating Machine. Frederick W. Hedgeland, Chicago, Ill. Application filed September 17, 1897.

There is the combination in a paper-perforating machine of a series of punches having toggles, a cam operating all the punches, a lifter for raising the punches after operation, a magnet for each punch having its armature connected to the toggle thereof, and a spring for each punch acting contrary to the magnet.

599,604. Electric-Railway System. James D. Gibbs, Chicago, Ill. Application filed March 14, 1896.

The system comprises a line conductor, a series of contact rails arranged in insulated sections and adapted to be enlivened when forced in contact with the line conductor, such rails overlapping at their ends, and a trolley having two contact wheels, each provided with a double tread.

599,635. Electric Arc Lamp. Henry J. Sage, Rochester, Pa. Application filed March 19, 1897.

In combination with an arc lamp provided with a carbon socket supported by rods from the base of the lamp and a threaded lower extension there is an inclosing casing below the base provided with clips embracing the rods, a globe, and a globe-holder screwed upon the threaded extension.

599,654. Fire-alarm Box. John H. Hayes, Appleton, Wis., and Charles Fisher, Chicago, Ill. Application filed January 21, 1897.

Features of the combination are an electrical circuit, a switchboard, electrical conductors leading from different contacts of the switchboard, a switch-lever pivoted to the board, an arm connected to the switch-lever and a starting lever for actuating the switch-operating arm.

Western Electrician.
EVERY SATURDAY.
Vol. XXII. CHICAGO, MARCH 12, 1898. No. 11

Auxiliary Cars in Storage-battery Traction.

Although the Western Electrician has described in detail the Englewood and Chicago storage-battery road and the efficiency tests made on the plant (Western Electrician, August 7, 1897, and February 5, 1898), it is believed that a brief description of the auxiliary car equipment recently put into service, with the accompanying pictures, will be of interest to those who are following the development of this departure in electric railroading.

The road is now owned by the Chicago Electric Traction company, with E. R. Gilbert as general manager and A. E. Davies as superintendent. It has been operated successfully during a trying winter, the only interruption being of a few hours' duration during the great storm which did so much damage in the West during the latter part of January. The line is 13 miles long and extends through thinly settled suburbs. It is double-tracked for all but a distance of 2½ miles at the Blue Island end, so that the task of keeping it free from snow was

no easy one. The snow-fighting apparatus is illustrated by the pictures on this page.

The snow plow is similar to those used on trolley roads, the difference being that it is equipped with storage batteries and has no outside wiring connections. It is 31 feet long, over all, and the length inside the car is 20 feet. The outfit weighs 20 tons, batteries included, and is mounted on a Brill truck with 425-pound, single plate wheels and four-inch axles. There are two batteries in the car, one tray above the other, and two 50 horse power Walker motors, one mounted on each axle, drive the plow. Each battery consists of 72 cells with a combined capacity of 200 ampere-hours. Each battery supplies current to one motor through spring contacts and insulated leads, the connection being made in a manner corresponding to that on the regular passenger cars. The method of sustaining the battery trays and of placing them in position is the same as in the ordinary cars. There is a controller at each end of the car and apparatus for raising and lowering the plow blades. A coal stove keeps the interior of the car at a comfortable temperature. The crew consists of two men—a motorman and a man who manipulates the plow blades—and the car has a mileage record, with one charge, of 24 miles through snow averaging nearly two feet in depth.

After the bulk of the snow is pushed from the track by the plow, the sweeper comes along and completes the operation with its rotary brushes. The sweeper employed is large and heavy, weighing 30 tons, and was built by the McGuire Manufacturing company. It is 33 feet long over all, the inside length being 28 feet. It is mounted on a truck having 4½-inch steel axles and 525-pound, double plate, 33 inch Griffin wheels. It has three batteries arranged in a vertical tier in the center of the car, and three motors, each of 50 horse power, connected in the usual manner. Two of the motors are mounted on the axles of the truck for driving the sweeper, and one is suspended on a horizontal shaft extending the length of the car and geared at each end to vertical shafts which in turn drive the revolving brushes. These brushes are 30 inches in diameter and are arranged to be raised or lowered at will, the bevel pinion on the vertical shafts being attached in a keyway of sufficient length to permit the desired change of position. The batteries are of the same size as on the snow plow, which, indeed, is the standard for all the cars. A clutch at each end of the horizontal shaft permits the coupling of either brush to the driving motor. The car is reversible in motion, and of course only the head brush is used. Ordinarily, in sweepers of this description the connection between motor and the revolving brushes is by means of sprocket wheels and chain, but the direct gearing is found to be better, as it gives sufficient flexibility with no lost motion and no danger of chain breakage. The motors are four-pole, iron-clad machines, wound for 140 volts. Four controllers are used, two at each end of the sweeper. One controller of each set regulates the car-propelling motors and one the brush-driving machine. The crew consists of a motorman and a man to operate the brushes. The car has been in use since December and has given satisfactory service. Its record, on one charge, is 18 miles. In summer the sweeper will be used to clear the tracks of dust and dirt.

An interesting example of the work done by the snow plow and sweeper is shown by the picture on the next page. The photograph was taken on January 29th and represents a cutting on Vincennes road, near One-hundred-and-twenty-third street, where some of the snowdrifts were four feet deep.

AUXILIARY CARS IN STORAGE BATTERY TRACTION.—SNOW PLOW AND SWEEPER.

For special occasions the company provides the handsome car Virginia, which is illustrated on pages 152 and 153. This is a double-vestibuled car 34 feet long 7.7 feet inside measurement, mounted on a Dupont truck equipped with one 50 horse power motor and one battery. The exterior is finished in dark olive-green, with gold trimmings, and the interior woodwork is of mahogany. An olive-green carpet, plate-glass windows, a ceiling tinted dark blue, comfortable chairs and tasteful electric-light fixtures give a rich and quiet effect to the interior, which is lighted by 24 incandescent lamps and heated by an oil stove. As there are four cemeteries on the line of the Englewood and Chicago road, this car is used as a funeral car as well as for pleasure parties. When used for a funeral the casket is placed inside the car through one of the end doors provided in each vestibule. The doors for passengers are at the sides of the vestibules. The interior of the car is arranged so that it can be divided into three sections by the heavy portieres shown in the interior view. One of these compartments can be reserved for the casket, but often the curtains are drawn back and the casket is deposited in the center of the car, with the mourners seated about it. This car was built by the St. Louis Car company.

Pan-American Exposition Deferred.

Buffalonians have abandoned the idea of holding a Pan-American exposition near that city in 1899, owing to the lack of financial support of the scheme. It will be remembered that Captain John M. Brinker, president of the Niagara Falls and Lewiston railroad, is president of the Pan-American Exposition company, and that Hon. W. Caryl Ely, president of the Buffalo and Niagara Falls electric road, was selected as director-general of the project. The status of the scheme is recited in the following official statement: "While the progress made in the financial arrangements for the Pan-American Exposition has been of a very satisfactory character and the interest manifested by the citizens of the various communities on the Niagara frontier has been most encouraging, the immediate development of the project has been arrested by the unsettled condition of the public mind because of the Spanish-Cuban complications and the consequent apprehension of war. On account of this condition of public affairs it is believed by those best able to judge that at the present time it would be practically impossible to secure from Congress that recognition for the exposition which is considered eminently desirable to insure its success. It is not improbable, however, that the condition of material affairs may before long assume a more pacific phase. If this proves to be the case, the question then confronted will be: Will there be sufficient time left in which to carry out the exposition in comprehensive and effective manner upon the lines hitherto contemplated? Possibly the answer may be in the negative, but even then it by no means follows that the project will have lost its vitality. A postponement of the time of holding the exposition for a year or even until 1901 may be found expedient. Those originally interested in the enterprise will not definitely abandon it until every means of carrying it to a successful issue has been exhausted."

Liberal Appropriation for Electrical Extension in Chicago.

In the general appropriation bill presented this week to the aldermen of Chicago the new Department of Electricity fared better than any other, asking for $230,804.96 and securing $250,255. This includes an appropriation for the extension and reorganization of the fire-alarm telegraph system, $120,000 for the extension of the municipal electric-lighting plant, $30,000 for maintenance, $15,755 for salaries and $12,200 for the electrical inspection department.

George A. Holderness and W. J. McDiarmid contemplate establishing a telephone system in Fayetteville, N. C.

Practice of Theory.[1]

By J. C. McMynn.

The subject of this short paper reminds me of a trolley car, for the reason that it can be turned either way and run equally well. Whether the subject should be "Practice of Theory" or "Theory of Practice," I must leave for your judgment.

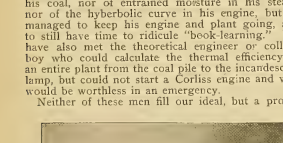
In the development of electrical machinery, together with the necessary steam auxiliaries, theory and practice have been the complements of each other, and neither could have reached the present stage of perfection without the assistance of the other.

Theory is much more progressive, and, as a usual thing, precedes practice, for practice paves the way and lays the track and makes it possible for the practical man to become a factor in the engineering profession.

The object of this paper is neither to practice nor decry theory or practice, but to simply recall to your minds the close relations existing between the theoretical man and the practical engineer; to a certain extent we are all theorists, for we have our own original ideas and fancies, and oftentimes the engineer who prides himself on being a practical man is the most theoretical.

However, it is with regret that I notice that the old-fashioned engine driver is fast disappearing. How he could sneer at and deride "book-learning" and "book-foolishness!" But he deserves our respect and admiration for the success he attained, and the work which he expended happily but unnecessarily. He knew nothing of the B. T. U. in his coal, nor of entrained moisture in his steam, nor of the hyberbolic curve in his engine, but he managed to keep his engine and plant going, and to still have time to ridicule "book-learning." We have also met the theoretical engineer or college boy who could calculate the thermal efficiency of an entire plant from the coal pile to the incandescent lamp, but could not start a Corliss engine and who would be worthless in an emergency.

Neither of these men fill our ideal, but a proper



AUXILIARY CARS IN STORAGE-BATTERY TRACTION.—A SAMPLE OF THE SNOW PLOW'S WORK.

combination of the two will give us an able, earnest, thoughtful and cautious engineer. Engineering colleges are to-day turning out, year after year, educated engineers who are exerting a strong influence on the profession, which is resulting in a strong union of practice and theory, the outcome of which must necessarily be engineers of a high standard, with broader and deeper foundations of learning and experience.

In my idea the application of theory to practical work is of the utmost importance to every owner of steam and electrical machinery. In construction work as well as in operation it is most valuable. To be sure, an engineer can consult a text or handbook and can there find out that masonry will sustain certain loads or that a girder of given dimensions will support a certain weight, but if he is unable to understand "the how" and "the why" he is much more liable to make an error.

To a certain extent the manufacturer represents the practical side of engineering, while the inventor and consulting engineer represent the theoretical side; yet frequently the manufacturer sees the advantage of practicing theory, and in such cases we see experimental laboratories established in large plants and original research carried on under the supervision of the most competent theorists.

I firmly believe, after mature observation, that the educated engineer who can master practice as well as theory is the one who will rise above his competitors in the future. Yet, do not understand that by "educated" I mean necessarily a college graduate. A man who can master the laws of mechanics, and can conquer mathematics by his own exertions, is deserving of more credit than one who was sent to college and learned simply because it was pounded into him.

Nearly every modern machine is an example of practical application of mechanics and design to theoretical ideas or discoveries, which thus become mechanical laws. Men knew that the electric current would some day become of commercial value, and long before the perfected dynamo appeared the laws governing the generation of the current were known.

A recent invention is a good example. For years we have known that a boiler-feed pump was doing much more work than was necessary, for if water were pumped into a closed tank above the water level and then the tank were opened into the boiler, the water would run into the boiler by gravity; the pump would be pumping against a 20-foot head instead of perhaps a 200-foot head. The recent invention consists of forcing the water to a level above the boiler, and then shutting valves and utilizing gravity. The saving made is about 85 per cent. of the steam formerly used by the pump. I simply mention this as a good example of the "Practice of Theory."

In a certain way, theory is the foundation and practice the structure of an engineer's attainments. The deeper and more substantial the foundation, the higher and more imposing can be the superstructure; the more substantial the foundation, the more resistance will the structure have to the winds of adversity and the more dangerous gusts of flattery and adulation.

A Survey of the Possibilities of Electric Heating and Cooking.[1]

By W. P. Adams.

Heating appliances do absorb what appears to be a large amount of electricity, and many electricians, especially those more closely connected with electric lighting, are surprised at the large amount of current which is necessary for cooking purposes, and mentally compare what might be done with the same current if devoted to the production of electric light.

As it is in the direction of electric cooking that I anticipate the largest development in the near future, I shall confine myself at first to a consideration of this subject.

In a kitchen suitable for supplying the needs of a family of from 8 to 10 persons the following apparatus would be necessary: Oven, absorbing 2,500 watts when heating up for about 15 minutes, and on the average about 1,200 watts afterward. Breakfast cooker, wound for two circuits, each absorbing 600 watts. Two grillers, each wound for 500 watts. Two frying pans, also wound for 500 watts, and several hot plates for warming ordinary saucepans, or in place of these several self-contained electric saucepans. These plates or saucepans would probably absorb 1,500 watts together. The household supplied from such a kitchen would probably have a maximum demand for not more than 2,500 watts for lighting purposes. The total watts which could be absorbed by the cooking apparatus is 7,200. It must, however, be borne in mind that these various appliances are used at different times, and never all together.

We shall now consider the difficulties in the way of the adoption of electric cooking. First and foremost is the question of the cost of current. This is all-important. In addition to this the first outlay cannot be overlooked, owing to the rather high cost of the apparatus.

The largest field for the development of electric cooking is undoubtedly in private houses supplied from central stations, and if there is to be any large extension in this direction the central stations must be prepared to supply current at a considerably reduced price than is now charged for lighting. It is generally recognized that electric cooking will eventually prove to be the means of solving the much-vexed question of securing a day load for central stations; and, in view of this fact, many of the central stations offer special terms for supplying electric currents for heating. A number of the central-station engineers are, however, still doubtful as to the advantage of combining cooking and heating, partly owing to the question of the load overlapping the lighting load. This question I shall touch on later, but I would venture to point out that, if the demand is spread over a sufficient number of hours, electric heating is worthy of consideration on a par with from electric lighting, and it would therefore pay to put down extra plant to meet the additional demand. In fact, I do not think the day is far removed when the demand for current for electric heating will vastly exceed that for lighting purposes. I submit that the solution of the question lies mainly in the hands of the present suppliers of electricity. If they are prepared to adopt a liberal policy of supplying electricity for heating purposes, perhaps at little more than the actual bare cost, they will very soon find that the improved conditions under which they run their plant will begin to repay them handsomely.

The Wright system of charging for electricity appears to be securing considerable support amongst central-station engineers, and the maximum-demand system seems to have been receiving even greater favor. With both of these systems I can foresee a double connection with the supply of electricity for heating purposes.

Under the Wright system it is conceivable that the demand meter may run up to a most unusual height, through the inconsiderate switching on of a number of the heating appliances together, the indicator, therefore, furnishing quite an abnormal record upon which the charges are to be based. Again, with the maximum-demand system, if the charges are to be made upon the usual understanding, that the whole apparatus is to be run for an hour at the maximum charge before any reduction is made, the charge cannot come down to anything like a reasonable figure. It is, of course, obvious that the whole of the appliances will not be in use together, and I think this point is worthy of close consideration.

In a certain kitchen it was found that the various cooking appliances were in use for from five to seven hours a day, during which time the highest point reached was 1.5 kilowatts. The average consumption during the day was from eight units. It will thus be seen that if generating plant to the capacity of two kilowatts was installed for supplying these cooking appliances, it would have an earning capacity of about 1,400 units per kilowatt installed per annum.

I find that the number of units sold per annum per kilowatt of plant installed varies considerably among the different stations in country towns where the load is almost exclusively a lighting one and the supply is very small during the daytime. About 400 or 500 units represent the work done during a year by one kilowatt of plant installed. In the larger towns, where there is probably a small day supply for power as well as one for lighting in dark offices and basements, the demand is larger. In Brighton, 840; Edinburg, 640; Glasgow, 696; Manchester, 700. It will be seen that Brighton, which might also be termed a country town, as there are no factories there to absorb power in the day, shows the best results of those named. This, I think, is traceable to the moderate nature of the charge for current.

As a load for summer time, cooking should prove invaluable to supply stations, and the question of overlapping during this period does not arise.

AUXILIARY CARS IN STORAGE BATTERY TRACTION.—INTERIOR OF SPECIAL CAR VIRGINIA.

In winter, however, the conditions will be different. A certain amount of overlapping will occur owing to the prevailing fashion of late dinners, but I submit that the load for electric heating is likely to be of sufficient importance to warrant putting down additional plant to meet this.

Much, of course, depends upon the acuteness of the peak as to how this question is to be met. If it can be arranged, it will be desirable to utilize for heating during the day the plant installed for lighting purposes, but if the demand for heating grows to such an extent as to greatly surpass the lighting load, the question becomes of less importance. It is not, perhaps, within my province at this moment to suggest how this difficulty is to be met, but with some stations in this country the question does not arise at the present time, as ample plant has been installed to meet the lighting requirements and still leave a balance in hand to allow for the overlapping. A number of stations appear to be provided with twice the amount of plant required to meet the maximum demand. Of course, some portion of this is reserve plant, but there still remains a good balance in hand to meet this contingency.

I am inclined to think that a secondary battery would prove of great value in meeting the peak difficulty, as there are several depressions on the day-load curve which could be filled up if the generating plant were employed during these times of light load for charging the accumulators. How far it is possible to economically utilize accumulators for this purpose in alternating supply stations is an open question.

While considering the charges made by the various supply companies it is noticeable that several have adopted the enlightened policy of charging for power and heating purposes a price which is actually less than the total works' cost. Putting on one side for one moment the question of overlapping,

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1. Read before the Northwestern Electrical Association, at Milwaukee, January 20, 1898.

1. Abstract of paper read before the Northern Society of Electrical Engineers, England.

it is obvious that this is a right policy to adopt, as, assuming that the plant used for lighting is employed for supplying heating appliances, the charge for rent, management, etc., will remain practically the same.

I have the misfortune to be situated in a district served by the City of London company, which company holds a monopoly and takes advantage of this to maintain a charge which is worthy of the very early days of electric supply. Although their works' cost compares anything but favorably with other large towns, having in many cases a much smaller output, I think you will agree with me that the charge of 8d. is somewhat extravagant, and I may say that such a charge absolutely prohibits any demand for current for power and heating purposes. It is true that a rebate is made if more than a stated quantity of electricity is used, but this is fixed so that it is of little value in the way of reducing the price.

It seems almost incredible that, in these enlightened days, the foremost city in the world should be one of the worst supplied in the matter of electricity.

I have so far made no comparison between the cost of cooking by electricity and that by other means. I shall not deal with this question much in detail, as I think it more practical at the present time if a general idea is given as to what the actual consumption of electricity will be, for the cost by other means varies largely under different circumstances. I have, however, some figures to hand obtained in a kitchen where both gas and electricity could be used at will. The household was a small one, consisting of about five persons, and the consumption of electricity was approximately 30 units per week when cooking was done solely by this agency. When gas was employed exclusively, 1,200 cubic feet of gas were used during a week. The cost, then, of electricity at 2d. per unit is 5s. a week, and of the equivalent amount of gas at 3s. per 1,000 cubic feet is 3s. 9d.

The figures of consumption which I have given above are the most complete at my disposal, and this is my reason for bringing them before your notice, but I have other results to hand which indicate that the consumption of current may be reduced below the figures given when the appliances are used intelligently and with care. For small installations such as we have considered one may assume roughly that a unit per head per diem will suffice for all cooking purposes. These figures will naturally be reduced in larger establishments, and experience seems to point to about [illegible] unit as a sufficient allowance in kitchens where more than 40 or 50 persons have to be provided for. The best results will be obtained where there is a hot-water supply. Many of you are probably aware that heating water by electricity is a most uneconomical proceeding, at any rate at the present prices, and where an establishment is sufficiently large it is always recommended that a [illegible] combustion stove is fitted to supply all the hot water for the household. In many houses such a stove is already fitted.

There is one direction in which one might anticipate a large development of electric cooking, and that is in flats. If architects will arrange for a general hot-water supply for the whole building, as I believe is now done in many cases, electric cooking presents so many advantages that an important movement in this direction should take place when the supply companies are convinced of the advantage of charging such prices as will be generally acceptable. I think I have said sufficient to indicate that even with electricity at 2d. per unit electric cooking is not extravagantly expensive, and if its other great advantages are taken into consideration, particularly the economical results from the protection of the cooking, it ought to be received with prompt favor.

I am hoping that before long those responsible for electricity supply will begin to make a definite move in the development of electric heating and cooking. It is not sufficient to merely reduce the price of electricity to a reasonable figure, as many of the corporations have already done, but steps should be taken to induce people to become users of electricity for other purposes than lighting. The hire system, which the gas companies are much in favor of, should be adopted where possible. One of the difficulties which has been met with in the attempt to develop electric heating is the high first cost of the apparatus. This is largely owing to the comparatively small output of heating apparatus at the present time, and is also owing in no small degree to the many different voltages which the goods have to be made up for. You will probably be surprised to learn that there are no less than 14 different voltages in general use at the present time, and you will quite appreciate that this does not tend toward the cheapening of the appliances.

I have little doubt, if supply companies are prepared to give this matter their careful attention, that mutually satisfactory arrangements might be come to between themselves and manufacturing firms so as to meet these difficulties.

I have now to consider the practicability of using cooking and heating plant in connection with plant installed for lighting residences and factories.

In very few well-arranged and properly managed private installations does the cost exceed 4d. per unit, and in residences where accumulators are used it would simply mean running the plant a few hours a day extra if electric-cooking apparatus were adopted.

In factories where large electric-lighting plants are in use the same argument holds good. The probability is that the generating engines are supplied with steam from the main boiler system, and the man in attendance on the general machinery is expected to look after the electric lighting plant. The cost of generating electricity during the daytime for cooking meals for the staff of the establishment, and perhaps for the employes, is in such cases almost a negligible quantity.

I must here make a small digression to call your attention to the curious ideas some people hold with regard to electric cooking. An establishment in Liverpool has just installed a large and economical plant for electric lighting purposes, and it has been proposed to the owners that they should use it during the daytime for cooking purposes. I was asked by the electric light contractors to loan some apparatus for testing, and the conditions being distinctly favorable, this was done. A little later I was informed that the committee would not adopt electric cooking. I was anxious that the test should have been made under my supervision, but it was not thought necessary for me to be present. Inquiries were made, and I found that the committee itself had superintended the experiment, and had insisted upon the food being placed on the appliances before the current was turned on. As one of the elementary rules of cooking is that the apparatus should be heated up to the proper temperature before the food is placed upon it, you will understand that such an experiment was foredoomed to failure. I relate this instance as an illustration of the common idea that electric cooking apparatus is capable of doing things which no one would think of expecting from ordinary cooking apparatus, and simply for the reason that the word "electric" is used in connection therewith. Every electrical engineer at one time or another has met with peculiar ideas of this sort.

There is, of course, nothing magical about electric heating and cooking appliances. The advantages which we claim for them are: (1) That they are more economical in point of heat utilized than any other appliances; (2) that they are quite without equal in point of cleanliness and general convenience; (3) that there is practically no waste of material in the cooking; (4) that by their means cooking is reduced to a simple science and absolutely uniform results can be obtained, this being due to the ease with which the heating effect is controlled by switching. In the oven it is usual to fix a thermometer, indicating on a dial on the front of the door, and given temperatures can be maintained within a few degrees. I might further claim that such appliances are perfectly free from such dangers as attend the use of gas cookers. Explosions are impossible, and the risk of fire is nil.

I must now beg of you to spare me a few minutes for the consideration of electric heating by radiators.

I have already indicated at the commencement of this paper that this subject requires consideration from quite a different point of view to electric cooking. Assuming for the moment that there is likely to be any large development, you will at once observe that this will bring no load to the stations during the summer time, and, owing to the large amount of current the radiators consume, they will make the winter load heavy. It may be that persons who adopt electric cooking may be inclined to use the apparatus during the summer time only, on account of its coolness in the same way as people now adopt gas ovens, returning to the use of the kitchen range in winter. If this were done to any large extent it would probably meet the difficulty, and it might even be desirable for supply companies to give special terms for the use of electric-cooking appliances in summer, and increase these charges during the winter. Whether such a plan is feasible or not will have to be ascertained as the problem develops.

When estimating roughly what current radiators are to be wound for, for a given space, I generally assume that 500 watts will be necessary per 1,000 cubic feet of space, in the coldest weather. This, of course, is only a very rough guide, and in every case the general conditions must be taken into consideration. In my office in the city, which has a capacity of 2,000 cubic feet, with one outside wall almost entirely consisting of window space, I rarely use a larger radiator than one absorbing 600 watts. In very sharp weather I have found it necessary to put two of these on for the earlier part of the morning, and sometimes on Mondays, after a continued frost extending over Saturday and Sunday. In this instance it will be seen that a less quantity is required than 500 watts per 1,000 cubic feet of space. In the case of a building with several thin outside walls, and other unfavorable conditions, probably more than the 500 watts would have to be provided for.

With radiators consuming this amount of energy you will appreciate that electric heating is not likely to receive much support when such charges as 8d. per unit are made. At the beginning of last year I was requested by an architect to fit nine radiators in a spacious office in the city. The firm was a wealthy one, and expense was not considered an important matter owing to the convenience of the electric radiators. I pointed out before the order was placed that the cost of current would probably be very high; but, notwithstanding my warning, it was decided to have the radiators fixed. After they had been running for three or four months I was informed that the cost was so excessive that their use would have to be discontinued. With one or two small exceptions these are the only radiators ever installed in the city of London, and, while the prices are maintained at the present figure, little development is likely to take place; and yet the city is an almost ideal place for the use of electric radiators, owing to the fact that the bulk of the offices close at an early hour, and that the occupiers are willing to pay a good price for so convenient and sanitary means of heating as electric radiators provide.

Experience shows that even at so high a figure as 3d. or 4d. there is considerable demand for electric radiators, and this is not surprising when one considers that the heat produced is of exactly the quality that one could desire. It is not sufficiently high to deprive the air of its moisture. There are no products of combustion to vitiate the atmosphere, and the radiators are turned on and off with the same ease as the electric light.

I cannot now make detailed mention of the smaller heating appliances, but I think that their employment is one worthy of some consideration by supply companies. If they are at all largely adopted, they would be of value in increasing the day load, and it is likely that they would be employed at times when the cooking apparatus would not be in use. Take, for instance, the electric kettle. Each kettle takes from 300 to 500 watts, and they are mainly used for preparing tea in the afternoon. It is conceivable that if used in large numbers they would help to fill up the somewhat awkward dip in the curve occurring about three or four o'clock in the afternoon after the hot cupboard and plate had gone out of use.

In conclusion, I will ask you to be as lenient as possible when passing judgment upon this paper. I am well aware that I have been guilty of considerable temerity in venturing to read a paper upon a subject about which there is so little practical knowledge. My excuse for doing so is that I believe there is a reasonable probability of considerable development in this direction in the near future, and I hope that the figures which I have placed before you may help electrical engineers and others interested to understand better the lines that this branch of electrical engineering lies upon them.

AUXILIARY CARS IN STORAGE BATTERY TRACTION.—SPECIAL CAR VIRGINIA.

Electrical Engineering at Columbia University.

The new buildings of Columbia University, New York, are located at One-hundred-and-sixteenth street, between the boulevard and Amsterdam avenue, on the highest part of Morningside Heights, midway between Grant's tomb and the new Episcopal cathedral, commanding a view of the Hudson on the west and the Harlem River on the east. Thus situated, the university secures the manifold advantages of metropolitan life, and at the same time it is sufficiently removed from the hurry and noise of the city to preserve the collegiate atmosphere. This effect is still further increased by the fact that the grounds between the buildings form a plateau about 20 feet above the level of the grounds and streets outside of the group of buildings. By this arrangement great economy in space is secured, since it gives two more floors to each of the buildings situated around the edge of the plateau, the basements and sub-basements being above the level of the surrounding grounds. The raised level between the buildings also enables tunnels to be constructed which connect the various buildings with the central power plant of the university. These tunnels afford connection for steam and gas service

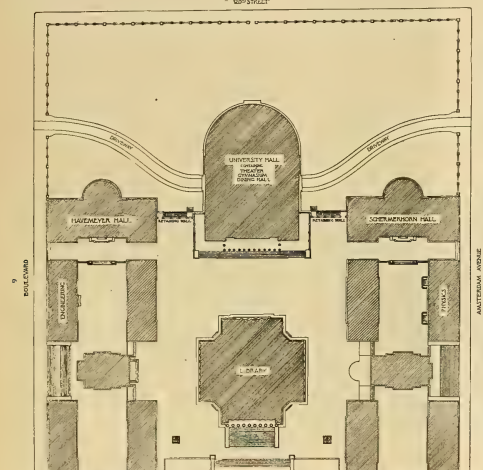


Fig. 1. Plan of New Buildings and Grounds.

Ninth and Tenth avenues, where it is well provided with buildings and equipment. All the other departments of the university, including Barnard College and the Teachers' College, which are affiliated with it, have removed to the new site.

The engineering building, a view of which, with its annex, is shown in Fig. 2, contains the departments of electrical, mechanical, civil and mining engineering. Havemeyer Hall, the chemistry building, is the home of one of the largest and best equipped chemical schools in the world, having been designed by Professor Charles F. Chandler and the officers of his department after a careful study of the principal colleges and technical schools in this country and abroad. The department of architecture is temporarily housed in the chemistry building, which has more than sufficient space for present needs. Schermerhorn Hall, the natural science building, contains the departments of geology, mineralogy, biology, etc., and their extensive collections. The physics building, which also accommodates the departments of mechanics and astronomy, is designed and equipped according to the modern methods for teaching and investigating physical science.

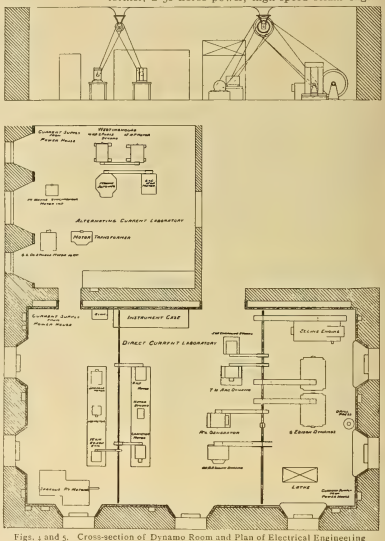
It is a striking fact, characteristic of modern tendencies, that all four of the new buildings, besides the library and university buildings, which are used for general purposes, are devoted entirely to science; and three of them are especially important in their relation to electrical engineering. Hence the course in electrical engineering at Columbia, which has already gained for itself a prominent position in electrical education in this country, has been materially benefited by the removal of the university to its new site. The principal improvements consist in a considerable extension of space and equipment in the electrical engineering laboratories, as well as in those devoted to mechanical engineering, physics and chemistry.

The regular four-years' course, leading to the degree of electrical engineer, is designed for the education of professional electrical engineers who intend to devote themselves to the practice of this profession, either as teachers in colleges and scientific schools, or as engineers, managers or experts in manufacturing or other industrial enterprises.

The course of instruction includes not only all important branches of theoretical and applied electricity, but also the other collateral sciences, which have been found by experience to be required by the electrical engineer, such as mathematics, physics, chemistry, drawing, analytical mechanics, mechanical engineering, including a thorough course in steam and other engines, as well as transmissive machinery and shopwork. General engineering, including construction in masonry, iron, steel and wood also forms parts of the course.

Hence the graduate in electrical engineering is provided not only with a thorough knowledge of the principles and practice of electricity, but also with such a broad and liberal education in the allied sciences as will prepare him for every demand that is likely to be made upon him in after life in connection with his profession, and will also enable him to become an investigator. The instruction is by lecture, recitation, laboratory, workshop and drawing-room practice, with periodical examinations. Special attention is given to new methods and forms of apparatus in order that the student may be brought fully abreast of the rapid progress of electrical science and practice. Frequent visits are made to the numerous electrical factories, stations and other establishments in and about New York.

The offices, laboratories, lecture and other rooms of the electrical engineering department are in the south end of the engineering building. In the sub-basement are located the storage battery and photometer rooms. The former contains a battery of 70 cells, to be used for efficiency and output tests and also as a source of steady potential and current. The photometer room is equipped with all necessary apparatus for determining the candle power of arc and incandescent lamps as well as other sources of light. In the basement are situated the two machine laboratories, the larger containing the direct-current machinery, while the smaller accommodates the alternating-current apparatus. These are shown in cross-section and plan in Figs. 4 and 3. In the former, a 50 horse power, high-speed steam engine



Figs. 4 and 5. Cross-section of Dynamo Room and Plan of Electrical Engineering Laboratory.

and the electrical conductors as well as the cartage of coal, ashes and supplies.

In this way these important practical matters are very conveniently carried on below ground as far as the college is concerned, but at the same time above the street level. Each building is provided with an elevator, chiefly used for carrying apparatus and supplies to and from the laboratories, lecture rooms and museums. Thus it is an easy matter to transport even heavy apparatus from any room in the university to any other room. To still further facilitate this service the door sills are entirely omitted in most of the rooms, so that a truck can be run about the buildings without jarring that which it carries, enabling apparatus to be arranged in the laboratory for use in the lecture rooms.

The location of the buildings at the new site are shown in the general plan, Fig. 1, the magnificent library presented by President Low being the central one and easily accessible from all the others. Only these buildings designated by names are already erected.

University Hall is the other general building, containing the power plant, gymnasium, academic theater, etc. There are also four new buildings respectively devoted to engineering, chemistry, natural science and physics. Two old buildings will be used for the present by the departments of ancient and modern languages and mathematics.

The schools of law, political science and philosophy are located in the library building, bringing them within convenient reach of the books upon which are especially dependent. The medical school will remain at Forty-ninth street, between

On the first floor, a plan of which is shown in Fig. 3, are situated the smaller lecture room (seating 70), ordinarily used for class work, and the larger lecture room (seating 150) for combined classes. In the chemical building, immediately adjoining, a still larger lecture room (seating 350) is available for meetings and public lectures. All of these rooms are provided with an ample supply of electrical energy of different forms, as well as gas, water and other facilities to enable experimental demonstrations to be conveniently and effectively performed. For example, dynamos, motors and other apparatus of practical size are shown in actual operation to illustrate the lectures, this being made a special feature of the instruction.

The museum contains cases for the collection of apparatus, models, materials, etc., relating to electrical engineering. This museum adjoins the

FIG. 2. ELECTRICAL ENGINEERING AT COLUMBIA UNIVERSITY.—ENGINEERING BUILDING.

lecture rooms, so that its contents can be conveniently used for illustration.

On the third floor are located the large instrumental laboratory, the research room and the studies of the officers. The laboratory contains a number of tables on which the instruments are permanently set up ready for use. These include various forms of galvanometers, ampere balances, standard cells and resistances; apparatus for measuring inductance, magnetic permeability, hysteresis and leakage; laboratory standard volt and amperemeters; telegraph, telephone and electric-signaling systems; thermo-electric and electrical heating devices; Röntgen-ray apparatus. The research room is used for special post-graduate and thesis work, and is fitted up according to the lines of investigation that are being followed.

A most important facility is the large and reliable supply of electrical current which is afforded by the central power plant of the university. This consists of boilers having an aggregate capacity of 2,000 horse power, two low-speed engines directly connected to two dynamos of 275 horse power each and two high-speed engines directly connected to two dynamos of 100 horse power each. This electrical generating plant, having a total capacity of 750 horse power, and illustrating the latest practice in electrical engineering, furnishes current for electric lighting and for driving the motors and fans used in ventilating all the buildings. Special conductors are also laid to convey to all the laboratories as well as lecture rooms of the electrical engineering department an ample supply of current for experimental work.

The physical laboratories and lecture rooms occupy four floors of the physics building on the eastern side of the university grounds. The building is supplied with all ordinary conveniences, including electricity for power and light, compressed air and steam. There is a vertical shaft 95 feet high with iron ladders and water outlet at every 10 feet. In the subbasement a constant-temperature room is placed 12 feet below the surface of the ground. A platform on the roof is available for meteorological observations, an instrument room being directly below. There are two lecture rooms, a library, an apparatus room and laboratories of various kinds.

The general elementary laboratory includes in its equipment linear and circular dividing engines of various designs. For measurement of mass there are provided balances with weights, specific-gravity apparatus, hydrometers, aerometers, and the various forms of vapor-density apparatus. Standard barometers, pendulums and apparatus for studying elasticity are provided, also apparatus for the study of sound.

The manometers and apparatus for their calibration and determination of zero and boiling points are supplied also apparatus for determination of coefficient of expansion, for latent and specific heat and calorimetry.

The optical room are furnished with a telescope of different designs, spectroscopes, telescopes, microscopes, sets of lenses, prisms and gratings, optical benches, photometers and apparatus for colorimetry, polarized light and spectroscopy.

In the rooms devoted to electricity are galvanometers of various patterns, high and low resistance, ballistic and damped; electrometers, magnetometers, standard cells, resistance, rheostats and bridges of all types; condensers, batteries, keys, arc and incandescent lamps, amperemeters and voltmeters.

THE MECHANICAL ENGINEERING DEPARTMENT.

The mechanical engineering department is located in the engineering building and in the annex, the space and equipment provided for it being greatly increased at the new site. This improvement is made not only on account of the importance of this branch in the electrical, civil and mining engineering courses, but also because regular courses in mechanical engineering have now been opened at Columbia for the first time, the space at the old site not having been adequate for the purpose. The department has the following equipment:

The woodworking and machine shops are located in the Teachers' College, One-hundred-and-twentieth street. For woodworking there are carpenters' benches with their kits of tools, speed lathes, sawbenches and planers. For forge and blacksmith work there are forges with anvils and tools, a Bradley hammer and a Billings & Spencer drop-press. For metal-working there are engine lathes with swing from 12 inches to 20 inches, planers, shapers, drill-presses, a universal milling machine, universal grinding machines and a Jones & Sampson turret lathe.

The testing laboratory is equipped with high-

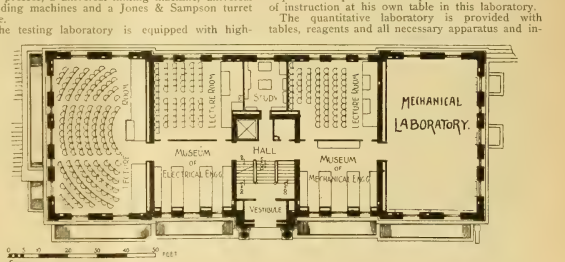


FIG. 3. ELECTRICAL ENGINEERING AT COLUMBIA UNIVERSITY. FIRST FLOOR ENGINEERING BUILDING

grade testing machines for tensile, transverse, torsion and compression tests. Their designs are of diverse types to give wide experience in handling and they are fitted with the best and newest appliances for observing and recording deformations of test pieces. The Emery testing machine, of 150,000 pounds capacity, is used as a standard of reference.

The mechanical engineering laboratory is well supplied with dynamometers of transmission and absorption types, with oil-testing appliances, speed recorders, tachometers, weighing and measuring apparatus, anemometers, gauge testers and the like, and representative machines and mechanisms for calibration and tests of efficiency.

The steam engineering and motive power laboratory has an extensive series of indicators, with appliances for calibrating and standardizing them, test-gauges, thermometers, calorimeters, pyrometers and apparatus for boiler and engine tests. A triple-expansion steam engine of the Reynolds-Allis-Corliss design is arranged to work on experimental steam engine by making it a three-stage air compressor when operated, and having all facilities for the accurate measurement of efficiencies. A full line of boiler-feed injectors is mounted for display and experiment. Steam engines of various other types, steam pumps, a 10 horse power De Laval steam turbine, hot-air and gas engines are at hand, and surface-condensing appliances as well. The department has also a cross-compound two-stage air compressor, the cross-compound steam end of which, with reheater, combined with the cross-compound air end with inter-cooler, makes a most complete example of applications of thermo-dynamic theory to practice. This laboratory is known as the Allis Laboratory, in memory of the late Edward P. Allis.

The hydraulic motor laboratory contains tanks, weir-notch equipment, gauges, current meters, water meters and motors for test and experiment. Constant pressure is secured by air pressure upon the water in a closed tank, thus doing away with a stand-pipe. For heavier pressures, above 100 pounds per square inch, an adjustable accumulator is used. Pumps of large capacity give the necessary quantity of water for orifice tests and other drill in hydraulic engineering. The equipment of this laboratory is presented as a gift to the university as a memorial of the late Henry R. Worthington of New York city.

The drawing academies are particularly well lighted and of large extent, and are fitted with the best forms of drawing tables and furniture, as well as extensive collections of patterns, models and illustrative drawings, blue prints, photographs and prints which are useful as copies and for training in design. Sectional models of actual machines and structural material are abundant, and for the study of projection, stone-cutting and warped surfaces there is a set of the Ollivier models, in which the elements of surfaces are represented by tense threads. In connection with the drawing academy is a room for blue printing and other solar work, and a photographic dark room.

The cabinets, or museum collections of mechanical engineering, exhibit models of mechanical movements, mechanisms and gearing, also material which has failed in service and under test. Specimens of apparatus and materials for practice are also included.

The chemical department occupies Havemeyer Hall, which is located at the northwestern corner of the group of buildings. It contains several chemical lecture rooms, fully supplied with apparatus and instruments and all modern facilities for the experimental illustration of the different lecture courses.

The museum of general inorganic and organic chemistry and of the chemical arts contains the elements and all their more important compounds, representative collections of specimens of all classes of compounds, materials and products, together with models, pictures and diagrams.

The qualitative laboratory is provided with tables, reagents, and all the necessary facilities to enable each student to become familiar with the reactions of the different metals and salts. The student is required to repeat all the experiments of the course of instruction at his own table in this laboratory.

The quantitative laboratory is provided with tables, reagents and all necessary apparatus and instruments to enable the student to actually execute quantitative analyses.

There is also a laboratory specially fitted up for electro-chemical work. The theoretical as well as practical branches of electrical engineering are taught by Professors F. B. Crocker and M. I. Pupin and Messrs. G. F. Sever, W. H. Freedman and S. G. P. Townsend.

BOOK TABLE.

ELEKTRISCHE LICHT UND KRAFT ANLAGEN ("Electric Light and Power Plants"). By Dr. Ludwig Fischer. Wiesbaden: 1898. Price, $1.65.

This is a volume of 317 pages, with 165 large half-tone illustrations. The author is the chief engineer of the Central Bureau (Hamburg) of the Export Union of German Electrical Manufacturers. The pictures form the principal feature, and many continental installations are illustrated. The book gives the results of European practice in compact and convenient form.

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Frank Foster Kenworthy being duly sworn deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the superintendent of the binding department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the binding of No. 22 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were sent out by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified.

And further this affiant sayeth not.

FRANK FOSTER KENWORTHY.

Subscribed and sworn to before me this 27th day of July, 1897.

Chicago, July 27, 1897. IRA B. JONES, Notary Public.

Four Years' Record of Electric Light Convention Advertising.

Issue	Number of Advertising Pages.	Whole Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894	40	56	4,145
February 23, 1895	52	68	5,593
May 9, 1896	72	88	7,576
June 12, 1897	80	100	8,643

No other electrical journal has ever equaled this record of 8,643 square inches of genuine full-paid advertising in a single issue.

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It is gratifying to receive assurances of appreciation such as those which have come from the independent telephone interests in all parts of the country since the appearance of the special number of the Western Electrician on February 26th, directing attention to the remarkable advancement already made in that field. Those engaged in that department are especially pleased with the excellent showing made on that occasion, but interest in the movement is not confined to those actively engaged in the independent field. Those who are even now associated with the Bell interests realize that a wider field of usefulness and a greater opportunity for personal advancement are presented in the independent movement. The electrical fraternity generally, outside the ranks of the telephone workers, encourages the opposition companies for similar reasons, and the public, which is vitally interested in the success of the independent movement, welcomes every development that contributes to its success, as it is by this means alone that permanent relief can be obtained from high prices in telephone service.

In view of the extent and diversity of the interests affected by the independent telephone movement, it is not surprising that the "Independent Telephone Number" of the Western Electrician should have proved such a popular publication. The new department devoted to this industry, which will here after be a feature of this journal, will each week contain the latest information obtainable, and, as its name implies, it will fairly represent the "Development of the Telephone Field."

The snow-fighting apparatus and special car of the Chicago Electric Traction company, described elsewhere in this issue, are interesting because of the storage-battery application. It is to be noted that thus far the storage-battery line has met every emergency of light, level railroading with success.

Opposition to the Bell interests has resulted in the introduction of the Brush telephone bill in the New York Legislature. The measure has been before that body in former years, but has never survived the ordeal of the committee. It is intended to restrict the local companies throughout the Empire state in their charges for service, but it is provided that these properties shall be enabled to earn 10 per cent. before the act shall apply to them. The chief objection to the measure on the part of the Bell companies, aside from the fact that those corporations resent interference and governmental supervision of their business, is that the actual cash investment shall form the basis upon which the percentage of profits shall be based. The valuation of the owners of the Bell exchanges upon the property will not be accepted. Other corporative influence is being exerted in behalf of the Bell exchanges in this struggle, and it is hardly possible that the bill shall be passed, although there is a formidable movement on foot against the Bell interests throughout New York.

At the hearing granted to the committee last week the friends of the bill presented petitions and arguments showing that there was a growing demand for relief throughout the state. The Bell companies will have an opportunity to present their defense before the measure is finally acted upon.

A study of the extensive use of natural water powers throughout Switzerland for the operation of machinery employed in the generation of electric current leads a contemporary to observe that a lesson is contained in this practice for Americans. In Switzerland, it is explained, there are many small streams, furnishing only a few cubic feet of water per second, which are tapped several hundred feet above the point where a power house can be conveniently built, and a cheap pipe line directs this energy upon the buckets of a Pelton impulse wheel or a Girard turbine. This power is largely used for the electric operation of mountain-climbing railways, which have grown so popular among visitors. While it is true that there is not the demand in this country for mountain-climbing roads that exists in the favored land of tourists, there is no reason why many minor streams should not be used in other ways. Many such sources of power in mountainous regions are not too far from points of utilization to be neglected, and it is contended that instead of searching for enormous water rights and organizing great development companies, some time and energy might well be spent in harnessing the mountain streams of America and setting them to work in the same effective manner as has been done with those of Switzerland. The suggestion is worthy of consideration.

Discussing the obstacles that have been overcome by American railroads during the last few years, the New York Sun calls attention to one important factor that will have to be taken into consideration in all future plans for steam railroading—the competition of the electric railway. It is pointed out that the development of the trolley system of traction has assured closer and cheaper connection between towns on the lines of railroad connection, and consequently the important and profitable item of local passenger traffic has been cut into severely. This is explained by the fact that electric lines are cheaply constructed, the roadbed costing little, and expensive locomotives and cars not being required. There is no burdensome transportation of fuel, no expenditure for terminals or stations, and practically no expenses for track walking or signaling. Many towns, more especially in the Middle and New England states, were built up by their proximity to a railroad, but during the last few years the passenger traffic between such towns has been diverted to a considerable extent from the steam to the electric railroads established to connect them; but the losses of the steam railroads have been made up by more progressive and economical operations. Incidentally, it is remarked that the government expended for mail service by electric and cable lines last year $325,000. The extension of electric lines in this manner is not confined to the New England and Middle states by any means. In Illinois, Minnesota, Ohio and Wisconsin there has been considerable development along this line, but it is expected that the plans now under consideration by several large steam railroads furnishing suburban traffic to Chicago will completely overshadow all that has heretofore been done in this department.

The tendency to place additional powers in the hands of the government, whether city, state or national, and incidentally to create lucrative offices for the friends of those who secure the passage of measures providing for these innovations, has reached a point where the subject is demanding public consideration. Among the bills of this kind introduced during the present session of the New York Legislature is one providing for an examining Board of Electricians "to examine and license" those having to do with electricity in any form, and requiring the payment of an annual fee of $25 for such certificate. The state of New York is already groaning under several commissions and boards which might be abolished without impairing public comfort or convenience. However, if the proposed board lived up to the requirements of the bill under which it is to be established the members would find plenty to do, although it is not equally certain that the electrical profession would be benefited. While it is true that the number of electricians in the state is comparatively small if the title be applied only to such as are proficient in the art, it is also a fact, as has been pointed out, that under the enlarged and constantly increasing uses of electricity, the number of persons indirectly, collaterally or remotely concerned with electric appliances is so large as to include a very considerable portion of the whole working population, and if the Legislature has in view the establishment of a license board for trolleymen, telephone girls, telegraph operators, lamplighters, cooks and janitors, the force of commissioners would soon become formidable. Yet, under the provisions of the bill, it has been contended that telephone operators and purveyors of push buttons would have to take out licenses at a cost of $25 per year. Such a bill is ridiculous, but measures equally absurd have found their way into the laws of New York and other states.

National Electric Light Association.

Preliminary arrangements are being made for the annual convention of the National Electric Light association at Chicago. On Monday last President Insull issued a call for a meeting of representatives of the electrical interests of the city at his office on Thursday afternoon at four o'clock "for the purpose of discussing what measures should be taken by local electrical interests for the entertainment of the visitors to the annual convention of the National Electric Light association, which will be held in Chicago on June 7th, 8th and 9th next." The following-named gentlemen were invited to attend the meeting:

W. W. Low, Electric Appliance company.
B. E. Sunny, General Electric company.
G. A. McKinlock, Central Electric company.
W. H. McKinlock, Metropolitan Electric company.
W. A. Kreidler, Western Electrician.
C. H. Wilmerding, Crocker-Wheeler Electric company.
F. W. Kohler, Kohler Brothers.
M. J. Insull, C. & C. Motor company.
R. J. Randolph, Excelsior Electric company.
Charles A. Munson, Fort Wayne Electric corporation.
C. D. Crandall, Western Electric company.
F. B. Badt, Meysenberg & Badt.
Charles E. Yerkes, Siemens & Halske company.
M. Coster, Westinghouse Electric and Manufacturing company.
J. R. Wiley, Standard Underground Cable company.
F. E. Donohoe, American Electrical Works.
J. B. Wallace, Wallace Electric company.
N. R. McLeod, Washburn & Moen.
L. A. Ferguson, Chicago Edison company.
John B. O'Hara, Western Electrician.
J. Holt Gates, Walker company.

Electricity in Mining Operations.[1]

By F. A. C. Perrine.

It is popular to say that we do not know the nature of electricity and therefore it is equally popular to use the name electricity as a conjuring word, assuming that its introduction into any particular system of operations would necessarily facilitate and cheapen them. Although it is true that we may now give a scientific definition for electricity as well as we can give a definition of light and heat, and a great deal better than we can define gravitation, we are not required to use an exact scientific definition in its engineering application. A sufficiently correct definition may be made by saying that electricity is a means of transmitting and utilizing energy without reference to the form in which the energy is to be employed. This definition includes the points of usefulness of electricity in engineering operations and excludes every other means of transmitting energy. Electricity has often been spoken of as a belt, but no belt can transmit and directly transform energy derived from the pulley of a steam engine into light, heat or motive power, as may be done by the use of this agency; and since it is thus readily transmitted to be used in all manner of energy transformations, it is capable of becoming the willing servant of the miner, as it has been successful in its application to other engineering operations.

In mining it has actually been successfully employed in milling, hoisting, haulage, pumping, drilling, lighting and in effecting electrolytic decomposition. Yet while these operations include almost the entire field of the miner, there is no doubt that the general introduction of this means of transmitting and utilizing power shows a decided tendency to lag behind other forms of development in mining operations along the Pacific Coast. For this there are undoubtedly two distinct reasons. In the first place, the machinery already developed has not been constructed with a view to the special conditions we find here, and in the second place the mining engineers and superintendents within this region have not obtained the special training that would enable them to adopt the machinery already constructed and adapt it to their special needs, or to develop new types of electrically operated machines to serve the particular problems we have here to face. In a sense, the lack of technical electrical training on the part of the mining engineers and superintendents who are operating our mines includes the first reason given for its tardy introduction in this field, since we should naturally expect the necessary machinery improvements to come from those most familiar with the particular conditions, and we may not therefore expect to see the best use made of this source of power transmission and development until those in charge of our mines have taken the pains to render themselves completely familiar with this branch of engineering. Even were suitable machinery available to-day these mining engineers and superintendents are not yet sure of themselves when left alone with the electrical machinery after the installing mechanic has returned to his factory, and until they are sure of their ability to do whatever repair work may from time to time be necessary, it will not be wise for them to attempt its use. A majority of the repairs must always be made on the ground and quickly, or the introduction of electrical machinery will have the effect of stopping all workings and flooding the mines while an expert is being sent from the nearest manufactory. Also such lack of training will generally bring about unnecessary break-downs from the development of little faults which the mechanic, untrained in this specialty, can never hope to foresee, since that which goes wrong in an electrical machine does not manifest itself to the eye or ear, or even to the hand, until it has reached disastrous proportions. The trained mechanic with his instruments can detect defects and repair them before they amount to break-downs. This training is something which the mining engineer must acquire, or his place will be taken by a new class of mining engineers, who can make use of this agency, for the many transmission plants now being developed in the mining regions will compel the introduction of electrical machinery as fast as the present contracts for water power shall expire and the cost of wood for steaming becomes excessive.

Again, as has been said, this new race of mining engineers will find before them many of the particular problems connected with the introduction of electricity into our mines entirely unsolved. The principal uses of electricity in mining operations at the present day are to be found in coal mines in the East, where the problems are altogether different from those met in gold and silver mining in either quartz or soft rock.

Perhaps the largest amount of power now used in these mines is absorbed in drilling, and while the electrical diamond drill is a successful machine, this drill cannot take the place of the pneumatic percussion drill, nor in this class of work can we make use of the coal auger or the under-cutting chain machine, so effective in coal mining operations. The electric percussion drill is to-day a failure in underground workings. Much surface quarrying has been satisfactorily done by its aid, but its great weight and the high temperature it attains place it at a serious disadvantage when compared with the pneumatic drill. Many times this problem has been attacked with great energy, and much money fruitlessly spent in an attempt to develop a satisfactory electrical percussion drill, with the sole result of proving that an electrical machine cannot be directly applied to this service. Whether there is or is not an indirect method of making use of electricity in drilling operations remains for inventive genius to show us.

But even in simpler needs than this of the percussion drill, it is evident that much engineering genius must be brought to bear on the problems before we can hope to see this form of energy successfully utilized. The best and cheapest wire cable to be used under the conditions here found is yet to be developed, and yet there is no need for any particular display of inventive ability. There is a necessity only for an engineering study of the particular conditions which are not at all those familiar to the manufacturers who are engaged in cable-making. They are prepared to furnish cables for the underground transmission of electrical energy, heavily insulated with rubber or other compound and protected by lead piping, but these heavy cables are difficult to maintain down vertical shafts, the lead being attacked by acidulated water and by the organic acids formed in the mine timbering. The manufacturers do not and cannot realize the immense importance of special construction for this field, although the information they now have at hand would enable them to construct a satisfactory cable for the engineer who is thoroughly familiar with the conditions under which the cable is to operate, and who has at the same time some knowledge of the materials available for their manufacture.

In the matter of pumping there is not a great difference between coal mining operations and those in gold, silver and copper mines, and in consequence there are to-day electrical pumps that can be used satisfactorily either for sinking or as station pumps, more satisfactorily and more economically than is possible by any system involving the transmission of steam. These pumps are not more economical than those operated by compressed air, where reheaters are employed, but as is well known the reheater is not always unobjectionable, and the electric pump has many advantages, even when compared with the use of the compressed air motor in similar service.

Electricity for haulage is also well developed, but as the haulage in the mines we are considering is of no very great importance, the advantage of the application of electricity does not carry much weight.

In spite of the fact that we know the electric elevator to be a safe piece of machinery when used under the conditions met within an office building or manufactory, the application of the electric motor to hoisting when the power is derived at long distance from one of the established transmission plants, is not entirely successful. These transmission plants deliver current at a high potential over a multiphase line, and although the induction motor is a good machine for steady power it cannot yet be considered thoroughly satisfactory when it is called on to start and stop frequently and to run at variable speed. This problem also demands considerable study on the part of the mining engineer, although it is a problem which the engineer may solve without attempting to become an inventor, since it is possible to transform the multiphase alternating current to a direct current by means of a rotary converter. This machine has been used satisfactorily in hoisting plants by applying to the hoisting gear a direct-current motor, which may be controlled by means of a rheostat, or even operated in two parts and controlled by means of the series-parallel controller. At the same time not every series-parallel controller is available for this use, since a difficulty is met, as the connection is changed from series to parallel and conversely. At that moment the motors must either be short-circuited or thrown on open circuit, and although this presents no difficulty in surface traction, where the cars maintain their speed on account of their momentum, opening the circuit of the motor while hoisting or lowering a car might cause an accident if the car was moving at a low speed without sufficient momentum for it to continue its travel during the time the change was being made in the connections. We thus see that the problem is one requiring a knowledge of the machinery to be employed as well as of the conditions under which it is to operate, which knowledge is only to be possessed by an engineer familiar both with practical mining and with electrical machinery.

Perhaps the most important application of electricity to mining at the present day consists of its use in electrolytic operations, and yet for these purposes we have as yet solved only the simplest problems, involving the deposition of a single metal, such as copper, from soluble anodes, and the recovery of other metals, such as gold and silver, from the slime remaining at the bottom of the electrolytic tanks. On the Pacific Coast this method of operation is far less important than the recovery of metal from leached liquors, could this latter operation be satisfactorily developed. Up to the present time it has not been attacked by anyone thoroughly familiar with all the conditions of the problem, whereas its solution would yield a rich harvest in the recovery of pure copper, in place of thousands of tons of copper now reduced by the cementation process.

This hasty review of the present condition of the field and of the improvements to be hoped for emphasizes a great need for training along the lines of the application of electricity to the particular problems of mining under the conditions as we find them. The solution of these problems is not merely something to be hoped for and something which may casually come in the future, but they are problems whose solution the present state of mining definitely demands, in view of the future expiration of water leases and the intense competition in mining, which will demand the employment of electricity furnished by the long-distance power transmission soon to be thickly scattered over the entire state.

[1] From the Engineering Journal.

Suburban Electric Service.

[From The Economist.]

It has been decided to equip the Evanston line [Chicago, Milwaukee and St. Paul Railroad company] for electrical operation. This will constitute a test of electrical operation as applied to steam-road passenger business, which will be fully as important as that of the New York, New Haven and Hartford road, undertaken about a year ago. The New York, New Haven and Hartford operates 12.3 miles by the third-rail system. As is well known, the eastern experiment has been successful form the standpoint of efficient service and lower operating expense as compared with steam. President Miller of the St. Paul said it could not be finally announced at this time whether the third rail system would be used on the Evanston line, but the presumption is that it will be, since the trolley has not been found very satisfactory for moving trains of the weight of steam road cars. The work of equipping the line for electricity will begin as soon as the City Council grants the necessary permit. For some time negotiations have been pending between the St. Paul road and the North Chicago Electric looking to the sale of current to the St. Paul, with which to operate the Evanston branch. As yet, however, the street railroad has not named a price which the St. Paul felt inclined to accept, and unless an understanding is reached in the near future the St. Paul will build its own power house. Mr. Miller says that the St. Paul will operate the road from Evanston to Chicago independently, just as it does at present. This step on the part of the St. Paul is obviously one of much importance, since if the test proves satisfactory other steam-road suburban lines will no doubt be equipped for electrical operation.

An English contemporary states that the Spanish government is still considering the advisability of constructing a direct cable to Cuba. At the same time it is negotiating with a French company which has a capital of $20,000,000. This company has offered to lay a cable from Hayti to Cuba within three months of signing an agreement, at an expenditure of about $1,000,000. The company does not ask for any money subsidy, but demands the right to work the cable for 25 years. The charge is to be fixed at one peseta (about 20 cents) per word, providing that the government will guarantee the company an average of 1,000 words per diem. The company undertakes not to make any claims for compensation or otherwise in the case of direct cables being established within the limits of this proposed time.

DEVELOPMENT OF THE TELEPHONE FIELD.

Praise for the Western Electrician's Independent Telephone Number.

The universal approval with which the "Independent Telephone Number" of the Western Electrician was greeted throughout the country and the substantial support that has since been accorded this journal's weekly telephone department are gratifying to all who are engaged in this work. The special telephone issue of February 26th is conceded to have been the most complete and interesting publication of the kind ever attempted. That it was appreciated is conclusively proven by the numerous letters of commendation that have since been received from all parts of the country and all classes of telephone workers. These letters show that a lively interest is manifested everywhere in the success of the movement, and that the aid and support of the Western Electrician is appreciated by those engaged in the development of this important industry. The following expressions are selected from the letters on file in this office:

Cabinet Manufacturing Company, Steubenville, O.: We think very highly of your Independent Telephone Number, and wish you much success.

William Roche, New York: The results from my "ad." in the Independent Telephone Number of the Western Electrician have been extremely gratifying.

Electric Appliance Company, Chicago: We think your Telephone Number is a very satisfactory paper and one that should do you a great deal of good in the telephone field.

Central Telephone and Electric Company, St. Louis, Mo.: We sincerely congratulate you on your Independent Telephone Number, as it is without doubt the best effort ever made in this line by any electrical journal.

Central Manufacturing Company, Chattanooga, Tenn.: We think your Independent Telephone Number a very creditable one and we think it should meet with the approval of all advertisers, as we feel sure they will get good results from it.

Keystone Telephone Company, Pittsburg, Pa.: Your Independent Telephone Number presents some very interesting reading matter to people interested in this line of trade, and we wish to congratulate you on the completeness of this edition.

American Electric Fuse Company, Chicago: We are more than pleased to inform you that your Independent Number of the Western Electrician of February 26th is more than we expected, and that it has done justice to all. We have received many inquiries from our "ad." in the above number. We believe the Western Electrician is the most valuable electrical periodical in existence to-day.

Farr Telephone and Construction Supply Company, Chicago: We are in receipt of the Western Electrician dated February 26th, which is called the Independent Telephone Number. We are very much pleased with this issue. The independent telephone companies should be proud of a journal that would devote so much space to their cause as this journal has. We think it is a great credit to the Western Electrician and hope that it will be appreciated by the independent companies.

Standard Telephone and Electric Company, Madison, Wis.: Your Independent Telephone Issue does you great credit, and is most complete as a beginning of the work which you have undertaken. That more of a similar character and of greater value to the independent telephone exchange movement will follow, I have no doubt. The first issue has very prominently called attention to manufacturing interests, but what follows should be for the good of exchange owners throughout the country generally.

Sterling Electric Company, Chicago: We wish to congratulate you upon your splendid effort by way of the publication of an Independent Telephone Number under date of February 26th. The editorial, typographical, mechanical and lithographical features are all gems of their own class. This number is a paper that, no doubt, will be widely read, appreciated and preserved for future reference. You are indeed entitled to a vote of thanks from the manufacturers and dealers in electric goods for the fair treatment which each has received at your hands in this publication.

Indiana Rubber and Insulated Wire Company, Jonesboro, Ind.: We have the Independent Telephone Number of the Western Electrician (issued February 26th) before us, and must say that we consider it a model number and one worthy of special notice. It will serve as an excellent reference book for the purchaser of telephone supplies. We have received a great many inquiries the last few days and nearly all advise that they have seen our "ad." in the Western Electrician. As these inquiries are from nearly every section of the United States we would judge that you have covered the field well.

Independent Telephone Movement in Indianapolis.

Managers of independent telephone exchanges in Indiana and others interested in similar properties met at Indianapolis on March 3d to consider the outlook at Indianapolis for an independent exchange. The visitors were anxious that the New Telephone company of Indianapolis should get a franchise so that they might have connection through their toll lines with the capital. Among the visitors in attendance were the following-named: Edgar W. Andress of Lafayette, C. S. King and William S. Stitt of Wabash, A. E. Reynolds, W. E. Nicholson, A. F. Ramsey and L. A. Frazee of Crawfordsville, E. C. Bickle of Elkhart, A. B. Irvin and J. L. Stone of Rushville, Will H. Craig, Charles M. Zion, E. Shirts and F. E. Heylmann of Noblesville, C. H. Reeves of Plymouth, John McGregor of Madison, George W. Beers, Charles McCulloch and Charles S. Bash of Fort Wayne. S. P. Sheerin, Harry Gates and Lewis C. Walker of the Indianapolis company were also present. The visitors presented long petitions from the business men of their respective towns, asking that the franchise be granted to the New company, as that would allow the independent companies connection with Indianapolis.

In the afternoon a hearing was given the petitioners by the Board of Public Works. The mayor, city attorney and city engineer were present, and the opposition company's stockholders had many influential business men on hand to urge its claims.

E. H. Andress, president of the Indiana Mutual Telephone company, explained the immense benefit to the state at large the granting of a franchise to the New company would be. He illustrated his remarks with a large map of Indiana, showing the independent companies' connections all over the state. The outside companies needed connection with the capital of the state. They served four times the number of subscribers that the old company does. This service would be doubled in another year.

S. P. Sheerin of the New company said: "There are now 137 towns in Indiana having independent exchanges. Many of these have no other telephone facilities whatever. There are connecting these towns, one with the other, in various ways, 4,600 miles of independent toll lines. I mean by this, not 4,600 miles of wire, but 4,600 miles of roadway, between county seats and other good county towns, covered by the independent telephone lines, and upon these 4,600 miles of toll lines there are situated and supplied with telephones 1,500 towns, large and small."

George W. Beers, president of the Fort Wayne Home company, said the company he represented has connections with exchanges in seven counties in the state, and with exchanges in about the same number of counties in northwestern Ohio, reaching in all 6,440 subscribers. He had no means, he said, of knowing the exact number of subscribers reached by the Bell company from Fort Wayne in the same territory, but it seemed to him safely within the facts to estimate the number accessible to the Fort Wayne exchange at 3,211. He argued that the city of Indianapolis should open the way for connections with independent lines, since their patrons outnumber the old-line users. The board took the subject under advisement.

Home Telephone Company Claims Victory.

W. H. Bryant, manager of the Home Telephone company of Mobile, Ala., claims that the decision of Judge Toulmin, in the case of the Western Electric company on the Scribner multiple switchboard patent, is a practical victory for the Home company. He said:

"The Home Telephone company is the only one that ever put up a fight against the Western Electric company, who have been claiming everything in connection with a multiple telephone switchboard. They at first claimed that seven specifications of the patent in suit were infringed, but abandoned all but three at the hearing of the case. The decision of Judge Toulmin sustains two of the three specifications. It is practically a victory for us, inasmuch as the points sustained by the court are immaterial to our system and can be obviated by the company at a small expense, and will not in any way effect our service, as we use an entirely different system from any other telephone exchange. The cost of making this change in our present board to come within the points sustained are merely nominal and can be made without interfering with our service for a moment, and in view of that fact we will possibly do so to avoid any future litigation based on this decision. We have 60 days in which to make the change before any injunction becomes operative under the decision, and we expect to be able to make the change within that time, should we decide to make it at all. As to an appeal from Judge Toulmin's decision, we have not as yet decided as to our course, but in view of the fact, as I stated before, that the change will not affect our service and is not excessive, I myself would be inclined to make it and let the decision stand as it is, without appeal."

Bell Company's Plans Miscarry.

(From the Chicago Record.)

The decision of Judge Toulmin of the United States Circuit Court for the Southern District of Alabama in the case of the Western Electric company of Chicago against the Home Telephone company of Mobile and Albert S. Lyons and Adam Glass, its president and treasurer, has a peculiar significance aside from the determination of the validity of the claims of the patent involved. The action was a suit in equity on a patent granted Charles E. Scribner of Chicago for a multiple switchboard, and was consequently of great interest to telephone companies operating large exchanges and using apparatus not made by the Bell licensees. Scribner is the chief expert of the Western Electric company, which is really the manufacturing branch of the Bell interests, as the American Bell Telephone company owns a majority of the stock of the Western Electric company and directs its policy and management. Consequently, it may be taken for granted that any litigation instituted by the Western Electric company is dictated in the interest of the powerful corporation of which it is a part.

On its face the suit in question was merely an action to sustain a valuable patent and a petition for injunction against the alleged infringer, but behind it all was an attempt to create a precedent for actions against individuals and an effort to cripple the anti-Bell companies that are growing so numerous and powerful throughout the country.

It looks very much as if the Bell company attempted to steal a march and that its plans miscarried. The avowed object of the litigation was only partially accomplished, the court sustaining two of the four claims for which the action was instituted, but prohibiting the enforcement of the injunction within 60 days of the recording of the decree. This latter provision was of itself no mean victory for the defendant, as it was made with the avowed purpose of preventing the complainant from taking advantage of the defendant and summarily closing its exchange. The court directed that this time be allowed "on account of the public inconvenience that might result in summarily enjoining the defendant in the use of its switchboard." Similar provision is made in the decree as entered in the record, thus establishing a valuable precedent in this particular class of causes.

But by far the most important feature of the decision and opinion was that directing that the complaint against the individuals named as defendants, the president and treasurer of the defendant company, be dismissed. The court finds:

"It is not shown in the evidence that defendants Alfred S. Lyons and Adam Glass have in their individual capacity violated any of the complainant's rights, or that they have individually derived any profit or advantage from the patent sued on. No reason is shown why a decree should be rendered against them as individuals. As to them, therefore, the bill is dismissed at the complainant's cost."

The importance of this ruling arises from its effect upon the policy of the Bell company in its litigation against the independent interests. The parent company's plans were based upon the supposition that it could pursue all who lent aid and encouragement to its rivals, and it hoped by instituting suits against individual users of "independent" instruments and stockholders in anti-Bell exchange companies to spread consternation in the ranks of rival concerns and their supporters. It would seem, however, as if Judge Toulmin's decision had raised up a barrier that could not be surmounted and that the campaign of intimidation would have to be abandoned.

At present the situation has more of promise for those who are opposing the attempts of the Bell interests to restore a monopoly.

Telephone Lines in Lee County, Ill.

The establishment of a complete telephone system by the independent interests in Lee County, Ill., has progressed so rapidly that the management now announces that it has succeeded in every way beyond its anticipations. The company commenced building a year ago last October and at that time did not have a subscriber. The first line was from Amboy to Lee Center, five miles, and Amboy also secured an exchange. A line to Eldena and Dixon was built and one telephone placed in the court house at the latter place, which was all that was placed there until the latter part of May. Then from Amboy a line was built east to Shaw, West Brooklyn, Compton and Pawpaw and south from Shaw to Sublette, and from Dixon to Grand Detour. This work was completed about January 1st and the company commenced getting subscribers to compete with the Central Union company, which had been established in the territory 15 years. The company concluded to charge $1.50 per month for residence service, $2 for offices and $2.50 for commercial business use. About the same time the Central Union company commenced putting in the multiple system, which it claimed was an improvement, and cutting prices to $2 per month. It then had about 160 subscribers, but the change did not prove satisfactory, and now the Central Union is changing back to the old style of operation and cutting prices again. At

present its rates are as low as $15 and $20 per year, but as the independent company has 250 subscribers, including all the old company's excepting about 30, and is giving subscribers free use of all lines in Lee County and Whiteside, besides Rochelle and Mendota, it thinks that free service, even, on the part of the Bell interests would do no harm. The Lee County Telephone company now has exchanges in Lee County at Dixon, Eldena, Ambcy, Harmon Sublette, West Brooklyn, Compton, Pawpaw, Steward, Ashton and Franklin Grove; and toll offices at Grand Detour, Nachusa, Chicago Road, Flagg, Lee Center, Shaw and Walton. It connects with the Whiteside County company at Prairieville, with the Ogle County company at Rochelle, and intends to connect with the DeKalb County company this spring at Lee Station on the county line and give subscribers the free use of all connections in the adjoining counties, but where a message crosses an adjoining county into a county beyond, then a toll of 10 cents will be claimed by the county crossed for service. The Lee County Telephone company has used the Western Telephone Construction company's switchboards and telephones mostly, and employed the common return system. It has 7,000 feet of cable in use in Dixon and the entire system is working satisfactorily.

Independent Telephone Exchange Company in Buffalo.

[From the Niagara Falls correspondent of the Western Electrician.]

To all appearances the Bell people are to have very active competition in Western New York, for in addition to the strong company which, as I reported recently, has been incorporated to to business in this field, another company of equal strength has filed incorporation papers in Albany to do a telephone business in the same field. This latest company is named the Buffalo Telephone company, and the capitalization is $500,000. At a meeting of the stockholders the following-named gentlemen were chosen as directors of the new company, and their names appear as such in the certificate of incorporation: George Birge, Daniel N. Lockwood, Leonard B. Crocker, Charles E. Williams, James Kennedy, William H. Kinch, William B. Hoyt and Reuben J. Getz. Humphrey, Lockwood, Hoyt, Greene & Yeomans are the attorneys of the company. The members of the company say they are out for business and are ready to commence construction as soon as they can get a charter from the city of Buffalo. Each company strenuously denies that it was formed to block the game of the other. In its certificate the company states that it proposes to operate a telephone line in Buffalo, to Lockport, Medina, Albion, Brockport, Rochester, Depew, Lancaster, Akron, Batavia, Churchville, Tonawanda La Salle, Niagara Falls, Lewiston, Youngstown, Hamburg, Angola, Silver Creek, Dunkirk, Erie, Pa., Ashtabula and Cleveland, O., and also in cities and villages other than those mentioned, in Erie, Niagara, Orleans, Genesee, Livingston, Wyoming, Monroe, Chautauqua and Cattaraugus counties. The people of Western New York welcome competition with the Bell company, and there is no doubt that the new companies will find it easy to get franchises in all the cities and villages if they show their sincerity in fighting the Bell people. However, the hope of the people is that the interests of the two companies will not be allowed to conflict so as to render their efforts ineffective in freeing the territory in which they propose to operate from the Bell monopoly. It is already intimated from Buffalo that the Buffalo Telephone company will have no trouble in securing a franchise in that city, its application having been presented before that of the Western New York Telephone company. The first mentioned company is said to have perfected arrangements for a circuit with systems in other cities not controlled by the Bell Telephone company. The organization of these two new companies no doubt means a bitter fight with the Bell people, but public sentiment in Western New York will be with the new companies every time.

Telephony in London.

There are troubles in connection with the operation of telephone exchanges in England as in this country, as the following comment from a London financial journal illustrates:

"The telephone company's service is becoming absolutely unendurable. Last night at five minutes to 11 an attempt was made to communicate with our offices and no connection could be obtained. Repeated rings till 11.15 were unavailing, and when a call through another exchange compelled an answer the young lady in charge at 'Gerrard' explained that she had been too busy to attend in the meantime. The correspondent who was endeavoring to communicate informs us that he does not send the usual present of gloves or game to the clerk in charge of the Gerrard exchange, and this doubtless explains the young lady's preoccupation. Complaints to the telephone officials are absolutely useless; the question, therefore, resolves into sending presents to the subordinate officials or remaining unserved. How long London will put up with the nuisance it is impossible to say, but the sooner a league is formed to remedy the abominable evil at present existing the better it will be for all concerned."

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Richland County Telephone company has absorbed the Richwood-Eagle company in Richland County, Wis.

The requisite number of subscribers has been secured in Muscatine, Ia., and the Mississippi Valley Telephone company will put in an exchange.

A telephone line will be constructed between Highland, Wis., and Clyde.

The council of Eau Claire, Wis., has taken a hand in the telephone war at that place by passing a resolution prohibiting the Wisconsin Telephone company from erecting additional poles or lines in the streets without a permit from the mayor and council. Charges have been made that the old company is interfering in every way, which are denied by its officers.

The new telephone company at Centerville, Ia., is securing many subscribers. Connection is to be made with nearly every place in the county.

The Iowa Telephone company has put in a new switchboard at Dubuque, Ia., to accommodate increasing business.

The Iowa Telephone company's application for permission to place additional poles for a long-distance connection at Waukon, Ia., was denied, the council fearing it meant trouble for the Standard Telephone company.

The Nicollet County Telephone company will build lines between St. Peter and Winthrop, Minn. Arrangements are being completed to form a company.

The Iowa Telephone company has completed long-distance telephone connection with Waverly, Iowa.

The application of the Minnesota Central Telephone company for long-distance franchise into St. Paul is being considered by the council. This company has just been granted a franchise in Minneapolis. Charges have been made by some of the assemblymen that the manager of the old company had approached them and asked them to absent themselves from the meeting and break a quorum. This, Mr. Freedy indignantly denies. He suggests that a complete examination be made of the company's lines and system, but denies that he has in any way attempted to do any underhanded work. The Mississippi Valley Telephone company is also an applicant for a franchise for a local exchange. It also has just been granted a franchise in Minneapolis.

A stock company is being arranged to build a telephone line between Billings and Lewiston, Mont.

The Eureka Telephone company has been formed at Eureka, S. D., and will put in an exchange. It will connect with the Dakota Central Telephone company's long-distance system.

Efforts are being made to secure an exchange at Elkton, S. D.

The Wisconsin Valley Telephone company's long-distance wires have reached Washburn, Wis.

The Northwestern Telephone Exchange company will extend a line from Lake Crystal, Minn., to Winnebago City, this season. Also from Blue Earth City to Elmore, and from Fairmont to Heron Lake. A new line will be put in from Mankato to New Ulm and probably as far west as Tracy, Minn.

The Mankato Citizens' Telephone company has secured 200 subscribers, and practically no soliciting has yet been done.

The La Crosse and Southeastern Telephone company held its annual meeting in La Crosse, Wis., and decided to extend lines to Cashton, West Salem, Bangor, Sparta and other points.

The Litchfield Telephone Exchange company, recently organized, proposes to extend lines to Eden Valley and other points in the county.

It is understood the American Telephone and Telegraph company will gain admittance to La Crosse, Wis., by the Wisconsin Telephone company building a line to West Salem, the nearest point reached by the American. The council of La Crosse has demanded as the price of admission to the field that the company give connection with all telephone companies in the city, and this the company very decidedly refused to do. The La Crosse Telephone company, an independent company, will seek to bring the lines of the Wisconsin Valley Telephone company to that city to meet the competition.

The Midland Telephone company of Ellendale, N. D., is to be extended to Monango, Oakes, Edgeley, Kulm and La Moure, making a complete circuit of La Moure County. It will later connect with Fargo and towns on the east.

An effort is being made to establish a telephone exchange in Allerton, Ia. The matter will be submitted to vote March 28th.

Western Telephone Manufacturing Company.

Among the enterprises incorporated at Springfield, Ill., last week was the "Western Telephone Manufacturing company at Chicago; capital stock, $2,000; incorporators, M. B. Kennedy, W. A. Bisland, S. C. Platt."

The name of this concern is similar to the one with which the incorporators are now identified, the Western Telephone Construction company. Mr. Bisland, in behalf of his associates, declined for the present to divulge the plans of the new corporation.

The Telephone Situation.

By J. J. Nate.

Part I.

"History repeats itself." In no enterprise of recent years has the truth of this saying been more fully realized than it is to-day in the work and organization of the independent telephone companies throughout the United States. In view of the fact that the telephone in its fully developed state has now been in general use for many years, and that the public at large is more or less familiar with its workings, it seems strange to a casual observer that this condition of affairs should exist. To those engaged in the work of manufacturing apparatus, and whose business brings them in close touch with promoters and organizers of independent telephone work, it is not at all strange, nor need it necessarily be so considered by anyone who appreciates the fact, that the general public has known very little of the scientific or financial work of the Bell company during its many years of monopolistic control. In a general way it does know that the Bell company's rates and methods of operation resulted yearly in large dividends, and that poor men became rich and rich men became millionaires in a very few years.

To the thinking and enterprising citizens of our country who have analyzed these conditions, two facts have been prominently established: First, that a telephone company could be successfully operated and pay a handsome interest on the investment where rates were much lower than those heretofore charged by the Bell company or its licensees; second, that the Bell company cannot necessarily retain its prestige on the ground of "a natural monopoly," if legitimately and thoroughly dealt with in fair competition. These are the men who have taken hold of this matter, and the result to-day is most flattering and satisfactory to promoters, and no doubt quite as discouraging to the Bell company and its licensees.

Time must determine whether it will be possible for the Bell company to duplicate the methods which for so many years retained to the Western Union Telegraph company its entire control of the telegraph business of the United States. Two factors enter somewhat into this possibility—one, an eventual and complete purchase of opposition interests; the other, a final adjudication sustaining the Bell company claims for the Berliner patent, on merit. The matter will first be dealt with by the United States Circuit Court of Appeals, and if in the several districts comprising the court there is a consensus of opinion there would probably be no possibility of carrying such suit or suits to the higher court, is true, but it is very generally believed that in no final court will the Berliner claims be sustained. Should there however exist a difference of opinion, it may result in taking the suit in question to the Supreme Court of the United States.

It is not, however, the intention in this paper to discuss the Berliner patent, because the questions naturally presented have been answered by men of legal ability, experience and learning many times and in many ways during the last two years. With a hope that some prominent evils may be eradicated and that something may be learned of the true situation of telephone work, its various phases are presented as fully and as accurately as time and facts thus far established will allow.

Organization.

Popular methods employed by promoters in the work of independent exchange organization, if legitimate, are, in nearly every instance, successful. These methods incorporate a canvass for subscribers at rates varying from $1.50 to $5 per month for telephones, according to population; a franchise for the construction and operation of an exchange covering a period of not less than 15 years; the employment of one or more practical and experienced telephone men, a wise selection of operators and the installation of an exchange under the supervision of someone who understands the work of telephone construction thoroughly.

The cost varies somewhat and is dependent on many conditions. It has been proven beyond question that a 100-number exchange can be constructed at a total outlay of $4,000, using the best of apparatus and pole-line material, No. 14 galvanized iron wire with a No. 10 hard-drawn copper return wire, poles ranging from 30 to 50 feet in height, having four to seven inch tops, office, pole and line-distributing facilities, switchboard and telephones of unquestioned merit. Such an exchange, operated at a cost to subscribers of $1.50 per month for resident and $2.50 for business connections, will net not one cent less than 20 per cent. on the original investment, if properly conducted. An exchange of precisely similar construction for 800 subscribers can be installed for $50,000, and will, under similar conditions, net anywhere from 10 per cent. to 20 per cent., according to apparatus used and economy exercised in operation. It would seem from such information as we have at hand that an exchange of from two to four thousand subscribers can be installed as a full metallic circuit, with an underground distribution of practically one mile from the office and of "A 1" construction at from $100 to $125 per connection, and if operated at rates ranging from $ 6 to $60 per year, the interest on

the investment should in no case be below 12 per cent., and it has been stated will net not less than 18 per cent at the lower rate indicated.

These statements are not made at random, nor without a knowledge of what they imply. On the contrary, there are now independent exchanges in operation installed three years ago that have, after deducting operating and maintenance expenses from the gross earnings, paid back to promoters dollar for dollar of their original investment, practically 33 per cent. on the original capital. From reports received over the signature of reputable business men engaged in independent-exchange work in different parts of this country, it is ascertained that the interest on their investment varies from 15 to 35 per cent. at rates varying from $1.50 to $4 per month for telephone service. Companies which were unfortunate enough in the beginning to employ incompetent men as superintendents in charge, and which purchased cheap or unsuitable apparatus, long since abandoned or remodeled, have found it necessary to devote their entire earnings to the work of operation and maintenance, and even in this class are to be found exchanges which last year paid eight per cent., after a reorganization and reconstruction of their plant. It is true a number of enterprises have fallen through and about 70 exchanges have either failed, reorganized, sold out to to the Bell company or still remain in the fight. Another proof as regards the earning capacity and cost of maintaining a telephone-exchange plant, and one which, to the writer, is more convincing than the information obtained from the independent companies, lies in the experience covering a period of over 19 years while employed in an operative and executive capacity by the most prominent Bell company exchange west of the Alleghanies. The entire apportionment of working accounts devolved upon a department over which the writer had full charge, and an inter-checking system was adopted between the various departments, resulting in a full and complete statement showing total cost of maintenance and operation monthly. From the knowledge thus acquired, the writer well knows that in a very large city a rate of $80 per year will net a handsome interest on the actual outlay necessary for the complete installation of a very big exchange. Don't let us forget, in the consideration of that rate, however, that royalties and $5,000 to $20,000 salaries are not included. It is also a matter of record that in the city of Chicago, and presumably in other large cities, the rate was $75 until after the Western Union deal was consummated, soon after which an advance to $125 per annum was made. The operating and maintenance expense of those days would compare favorably with the same item in the work of the independents at the present time, with a fair difference in favor of the new companies, owing to experience and improved class of material and apparatus, and also because labor is obtainable at more favorable rates per diem.

It is true of the Bell company that after nearly 10 years came the installation of multiple switchboards and construction of underground plants, in which millions were invested in Chicago and other large cities, which, for a time at least, must have taken all and possibly more than the total receipts of the companies interested.

Equipment.

An exchange of from one to three hundred subscribers can be handled by one or two operators at an average speed of 10 seconds on all connections furnished, and the apparatus need not necessarily be of an elaborate character in order to keep up this average without hardship to the operators.

In making a selection of exchange apparatus, purchasers should consider a few vital points, otherwise maintenance expenses will grow and subscribers become dissatisfied.

A switchboard for a small exchange should be of such reliable and simple construction that little if any attention is required, except in the nature of daily line tests and occasional repairs to cords or other auxiliary apparatus which may be subjected to severe and constant use. The instruments used in such an exchange should be of substantial and reliable construction. An automatic generator with switch of good mechanical construction, supplied with non-corrosive and positive contact points, a transmitter which will not pack and requires no adjustment, batteries of sufficient recuperative quality and merit to give an average service of eight months, a permanently adjusted receiver of the Bell type and well made, together with lightning arresters and proper terminal facilities, constitute all that any moderate size exchange requires in the way of apparatus.

In larger exchanges one or more men at good salaries must be employed who understand thoroughly the telephone business, both practically and theoretically. Switching facilities for distribution of connections throughout such an exchange must be provided for, and they should be of a character to admit of quick service and so arranged that subscribers are at all times in communication with the exchange, and I may here say that multiple boards are not at all essential to such a result.

[illegible] Operation.

Some supervision by the owners is required but not necessarily close attention, if care is used in the selection of a man to take charge. In a small exchange such a man can be secured for $50 a month—one who has had enough experience in the business to repair lines, keep the board and instruments in working order, make all the collections, and, if need be, keep the books. Fortunately, there are many such to be found. As a rule they are men who have served the Bell company faithfully and to little purpose. In case of severe interruption to the service, assistance can be secured at no great expense. For the office work one or two bright operators and a night boy will handle an exchange of 200 to 300 numbers very nicely, at a total expense per year about as follows:

Expenses

Rent	$ 120
Light and fuel	75
Manager	600
Two operators	420
Night boy	120
Battery maintenance	100
Line and sundries	100
Total	$1,535

Receipts.

One hundred telephones at $1.50 per month	$1,800
One hundred telephones at $2.50 per month	3,000
	$4,800
Less	1,535
	$3,265

Cost of plant, 200 telephones at $50, $10,000.

This result shows an interest on investment of over 30 per cent., from which it can readily be seen that 10 per cent., or $1,000 per year, can be allowed for operation and maintenance, or as a reduction in the earnings, or for both, and the net result will still be at the rate of 20 per cent. The same can be claimed for a plant of 100 telephones, as one operator only is required, and the cost of maintenance lessened by one-half. The rate of earnings for larger exchanges, unless at higher rates for service, will run somewhat lower. There are many unforeseen expenditures incident to an exchange of 500 to 1,000 subscribers which do not as a rule enter into the expense account of smaller exchanges, such as burn-outs from crossed wires, line reconstruction as new subscribers are added or repairs to lines after severe storms, increased taxes, damage suits, rentals for right of way on private property, and last, a regular inspection of subscribers' apparatus. Still, with all these adverse conditions, I can point out exchanges of 700 subscribers, at rates of $1.50 to $2 per month, paying eight per cent. on the capital stock, which may mean a better interest to preferred stockholders. With so favorable a showing, is it to be wondered at that capital is daily going into the independent telephone business? True, the subscriber may well ask, "If you are doing well, why not reduce the cost of telephone service?" Right here applies one of the few good arguments employed by the Bell company as an excuse for high tariff rates: "A telephone exchange company is at all times carrying a risk which cannot be estimated, and for which some provision must be made" not at the exorbitant rates heretofore existing, but at rates which may be termed "a happy medium." If no one meets with an accident in consequence of carelessness on the part of employes, no total destruction of switchboard by fire or water and temporary loss of rentals, no damage suits for injury from lightning because of improper wiring and many other similar causes—then, and only then can the promoters realize the handsome returns looked for, to which might be added that experience must be paid for and that is precisely what many of the independent companies have been doing for the last three years. But through it all they are still progressing, and, having passed the experimental stage, are now on the road to success.

COMMUNICATION.

National Telephone Manufacturing Company.

To the Editor of the Western Electrician:

As you doubtless are aware, the National Telephone Manufacturing company has been engaged since August, 1895, in the defense of a suit brought by the American Bell Telephone company for infringement of the patent of the so-called "Berliner" invention, which it is claimed covers all forms of microphone transmitters or contact telephones, and which has been deemed by the United States Patent Office worthy of protection by letters patent. The suit is a dangerous one, for behind this patent looms up the great telephone monopoly with its prestige and financial power.

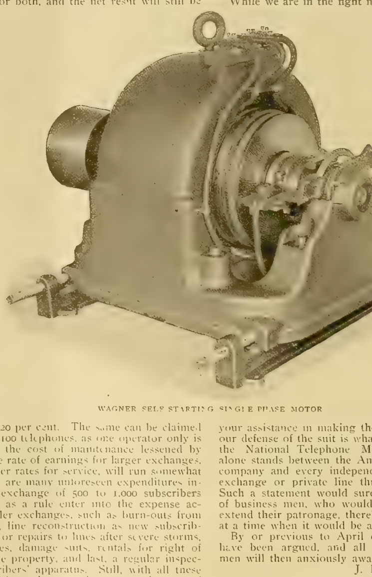
We have not only been handicapped by the heavy and enforced disbursements always attending such litigation, but we also have been compelled to carry an additional burden by and because of the circulation of iniquitous reports that the suit was a dishonest one and that we were in collusion with the Bell company in our defense.

Our answer is very simple, for the leading officials of the National Independent Telephone association, which was organized in Detroit last summer, have thoroughly investigated the situation and will corroborate the fact that our defense of the suit could not be improved upon.

While we are in the fight may we not count upon your assistance in making the facts clear to all that our defense of the suit is what it should be and that the National Telephone Manufacturing company alone stands between the American Bell Telephone company and every independent telephone factory, exchange or private line throughout the country? Such a statement would surely disabuse the minds of business men, who would no longer hesitate to extend their patronage, thereby tendering assistance at a time when it would be appreciated.

By or previous to April current our cause will have been argued, and all independent telephone men will then anxiously await the court's decree.

J. D. LEATHERBEE.



WAGNER SELF STARTING SINGLE PHASE MOTOR

Wagner Self-starting Single-phase Motor.

The Wagner Electric Manufacturing company of St. Louis announces the enlargement of its line of self-starting, single-phase, alternating-current power motors to include 10 and 15 horse power sizes for current of 60 cycles and $7\frac{1}{2}$ and 10 horse power sizes for current of 133 cycles. These motors are identical in principle with the smaller sizes, differing from them merely in point of mechanical construction. In the smaller sizes the operation of starting is performed by hand, while in the new sizes this operation is automatically performed. The commutators in the new sizes are of the radial form, the brushes running against the end in a manner quite clearly shown in the cut. In starting, the armature and field are connected in series. When the armature has run up to the requisite speed, this connection is automatically broken by a governor device within the armature body, the brushes being lifted off. Simultaneously the field alone is connected across the line and the armature completely short-circuited on itself. The motor then runs purely as an induction

motor. Only two wires from the line lead to the motor. No starting resistance box is required, no auxiliary device of any kind. A third binding-post provides an extra end to which the line wire may be connected when the supply voltage is low. The rated motor voltage is 104.

R. & H. Motor Starter.

The automatic starter and switch now offered to the electrical trade by Ross & Hailey of New York has a number of advantages which recommend it especially for elevator and printing-press installations, or for any similar class of work. This device is built of the best material, and of very heavy construction, so as to mechanically stand the strain brought upon it.

COMMUNICATIONS.

A Question of Identity.

To the Editor of the Western Electrician:

You will doubtless learn that the Warren Electric company of Chicago, Ill., is in the hands of a receiver.

To correct any misapprehension growing out of the similarity of firm name, we hasten to inform you that the appointment of a receiver for the Chicago company, an Illinois corporation, has no bearing whatever upon the Warren Electric Manufacturing company of Sandusky, Ohio, and does not affect it in the slightest degree.

WARREN ELECTRIC MANUFACTURING COMPANY. C. F. Mack, Treasurer.

Sandusky, O., March 3, 1898.

Another Question of Identity.

To the Editor of the Western Electrician:

It seems that some company which has a name similar to ours has been unfortunate enough to pass into the hand of a receiver. We of course sympathize with our namesake, but desire to inform the trade that while we have troubles this is not one of them and that we are still selling anti-trust lamps in large quantities.

WARREN ELECTRIC AND SPECIALTY COMPANY.

Warren, O., March 7, 1898.

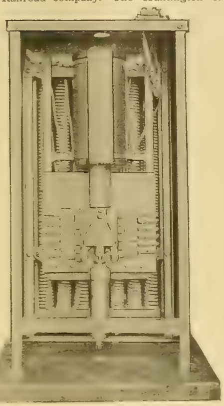
CORRESPONDENCE.

New York Notes.

New York, March 7.—Owing to the extent to which electrical apparatus is used in modern warships and coast defenses, the war excitement has an especial interest to electricians, apart from their patriotism as citizens. Many prominent electrical men were formerly naval officers, and at least one of them, Mr. Sprague, is said to have volunteered his services to the government. If war should come, the government will need the help of a larger number of trained electricians than it has in its service at present. Indeed it is stated that a number of men belonging to the Electrical Workers' Union of this city have been already engaged for service in the navy. Delegate Hoadley of the union asserts that six of its members were engaged on Friday by an officer of the Brooklyn Navy Yard and will be sent to the Mare Island Navy Yard in San Francisco. It was also said that Daniel Sullivan, another member of the union, was under engagement for service on the Holland submarine torpedo boat. Sullivan has served in the navy before. Other members of the union have been told to hold themselves in readiness for employment in the navy. Many machinists, steam fitters and boilermakers are also being engaged by naval officers.

The commissioner of bridges has made public the financial statement of the Brooklyn bridge for the month of February. It shows a falling off of $10,000 over February a year ago and of $18,000 over January of the present year. The falling off is unquestionably due to the trolley-car system now running on the bridge. The Brooklyn trolley companies started running cars regularly across the bridge on February 16th. Since then they have been running an average of 2,134 cars a day across the bridge, and they expect to increase this number to an average of 3,500. The loss to the bridge has not been a total gain for the trolley companies, for they charge no extra fare for the ride across the bridge. Before the new system the trolley companies charged the same fare for each passenger that they do now. They carried then a large percentage of the people they carry now. The increase in their traffic through crossing the bridge is at the expense of the elevated railroad.

Near-by electric railroads show increased activity. Application was made to Judge Gaynor in the Supreme Court in Brooklyn on Saturday for a writ commanding the trustees of the village of New Rochelle to give a hearing to the New York, West Chester and Connecticut Traction company, which desires to construct an electric railroad from Port Chester to the Harlem River. Consents, it was asserted, have been obtained to operate the road through Pelham, West Chester and Mamaroneck. The counsel for the road said that the West Chester Electric company, the New Rochelle Electric company and the Huguenot Electric company have had a hearing, and that the West Chester company had obtained leave to construct a road, but that the New York, West Chester and Connecticut company had been excluded from consideration. He said that his company intended to charge a fare of only five cents for the entire distance, whereas the other companies wanted to gridiron the district and charge 10 or 15 cents. Briefs were submitted and decision was reserved. At Mamaroneck, on Thursday, the village authorities granted to the Tarrytown, White Plains and Mamaroneck Railroad company a franchise to build an electric street railroad from Mamaroneck to White Plains. The road is to be in operation on or before July 1st, and will connect with a branch already in operation between White Plains and Tarrytown, forming a direct line from Long Island Sound to the Hudson River. Another recently granted franchise is that given by the trustees of New Rochelle to the Union Electric Railroad company to construct and operate trolley lines over the local streets. The company has filed a bond for $50,000. The franchise gives the right to operate electric cars from the New Haven railroad station to Starin's Glen Island dock, and thence to Larchmont Manor; also a line to Pelham, which will connect there with the present Mount Vernon line, giving the company a through route from Larchmont to One-hundred-and-twenty-ninth street, New York. On Long Island the Huntington railroad has been sold to the Long Island Railroad company. The Huntington railroad is three miles long and connects the village of Huntington with the Long Island railroad. It is the intention of the purchasers to change the motive power from horses to the overhead trolley system. M. S.



R. & H. MOTOR STARTER.

Canadian Intelligence.

Ottawa, March 7.—It is said that the St. Clair Tunnel company contemplates converting the motive power for the tunnel from steam to electricity. The matter is understood to be under consideration by Joseph Hobson of Montreal, chief engineer of the company.

At the next session of the Manitoba Legislature a local company will ask for a charter to build an electric railway from Winnipeg to St. Andrew's Rapids, and through the municipalities of Springfield, St. Boniface, Kildonan, St. Paul's and St. Andrew's. The company also proposes to construct sawmills, boats, telegraph and telephone lines.

There is a movement on foot to get an electric-railway service for the Island of Orleans, near Quebec. It is reported that a charter will be asked for an electric railway around the island. The power is to be obtained from Montmorency Falls.

It is understood that Engineers Keating of Toronto, Pearson of New York and Wanklyn of the Montreal street railway have visited the new Chambly works, Quebec, with a view to reporting upon the feasibility of using that power for the Montreal street railway, which, in producing its own power, expends about $360,000 per annum, while the Chambly people have, it is said, offered to furnish the company with power at a reduction of 25 per cent.

Work was begun last month on the power house of the Hamilton Cataract company, near Decew Falls, Ont., and it is being rapidly pushed toward completion. The building is to stand within a few feet of the edge of the stream and above high-water level, where the precipitous banks rise nearly 275 feet in height. When completed the power house will be 174 feet in length and 42 feet wide, and the walls 30 feet in height. It is to be constructed throughout of steel, faced with brick, and have cemented floors.

The progress which has been made in lighting by electricity is well illustrated by the statement contained in the report of the commissioner of inland revenue for Canada that there were 187 electric-light companies registered in the Dominion under the inspection act during the year.

From the plant which the West Kootenay Electric Light and Power company is erecting at Bonnington Falls, B. C., it is expected that the transmission of power to the Rossland mines will be commenced early this month. Bonnington Falls, where the power house is situated, lies about 11 miles below Nelson, B. C., on the Kootenay River. Water is conducted to the reservoir from the river by a canal 22 feet deep, cut out of rock for a distance of 640 feet. The two turbine wheels are attached directly to the generators. There are two generators, having together a capacity of 2,500 horse power. They operate at 180 revolutions per minute.

The Cornwall Electric Railway company has submitted to the Town Council of Peterboro, Ont., a scheme for the construction of an electric railway from that town to Chemong and Lakefield. The company proposes to lease the Chemong and Lakefield lines from the Grand Trunk railway, convert them into electric roads, and take over the freight business. The cost is roughly estimated at $350,000.

A new proposition for the supply of electric power to the city of Toronto has been made by the Georgian Bay Ship Canal and Power Aqueduct company. The price quoted is six mills per electric horse power per hour, the company agreeing to supply 2,000 horse power within two years from date of contract.

A live question now before the City Council of Ottawa is whether the Deschenes Electric Light company will be permitted to compete for electric lighting in this city in opposition to the Ottawa Electric company. A. V. W.

Northwestern Notations.

Minneapolis, March 8.—A stock company will be formed at Shell Lake, Wis., to install an electric-light plant.

The rates for electric lighting by the municipal plant at Valley City, N. D., have proved too low to meet all expenses. The income for four months has been about $310 per month and the expenses $390, the difference having to be charged to electric street lighting.

The council of New Paynesville, Minn., will be petitioned to submit the matter of electric lights to vote at the coming election.

The Minneapolis and Anoka Electric Suburban Railway company has been incorporated with $100,000 capital stock by Henry Lee, I. A. Caswell, A. E. Giddings, Thomas and John Coleman, John Dunn, Hiram Thornton, O. L. Cutter and Frank Hart. It is believed the Twin City Rapid Transit company is behind the company. The Twin City Rapid Transit company has just been granted permission to build a power dam across the Mississippi River at Coon Rapids, on the line of the proposed road.

P. Daugherty of St. Paul secured the contract to construct the electric-light and waterworks plant at Ortonville, Minn.

The Twin City Rapid Transit company will soon begin work changing the Fourth street cable line in St. Paul to an electric line. During the progress of the work tracks will be laid on Selby avenue from Dale street and Farrington street to the Rondo line. This will avoid transferring at the top and bottom of the Selby avenue hill, as was at first proposed, during the change.

Lake City, Ia., voted overwhelmingly for electric lights, and the contractors will soon begin work on the system.

The council committee appointed to investigate the feasibility of a municipal electric plant for St. Paul will shortly take bids on such a plant. The estimated cost of a plant with 1,500 arc lights capacity is $350,000.

Paul H. Sanborn, who has been granted a franchise at Waupaca, Wis., for an electric railway to the Chain o' Lakes, says that work will be begun on the proposed line at once.

The question of a municipal electric plant for Des Moines, Ia., will be voted on again at the coming election, the recent court decision having nullified the first vote. The mayor called a special meeting of the council to take action in the matter of submitting the question to vote again. The council failed to attend in sufficient numbers to make a quorum and thought the matter was blocked. The law provides for the submission of such matters on petition, and the mayor promptly circulated petitions and soon secured the required number of names. As the matter has to be published four consecutive weeks it was a narrow escape for the question. The coming election will be fought out on the question of a municipal plant.

The electric-light plant for West Liberty, Ia., has been completed and put in operation. C.

PERSONAL.

F. W. Vogel, lately superintendent of the Ohio Electric Construction company of Chicago, is now

signal engineer for the Railroad Supply company of Chicago.

J. Sterling Morton is to re-enter the field of journalism. He is to be editor of a new paper with the unique name of The Dynamo, which he will issue weekly at Nebraska City.

T. E. D. Ritchie, who has been for some time with Sargent & Lundy of Chicago, has gone to New York to take charge of the eastern office of the Fort Wayne Lamp company.

Stanley Green has resigned the western management of the Fuel Economizer company, after holding the position five years, and has formed a partnership with S. S. Howell, who was with the Fuel Economizer company for two years. The new firm will act as manufacturers' agents in Chicago, with the exclusive western agency for the American fuel economizer, made by Broomell, Schmidt & Co. of York, Pa.

ELECTRIC LIGHTING.

The Natchez Gas Light company of Natchez, Miss., will expend about $10,000 in improving and adding new machinery to its electric-light plant.

At last Monday's meeting of the Chicago City Council the mayor sent in a veto and an amendment to the ordinance granting the Consumers' Electric Light company an extension of time to lay its wires. The amendment requires the company to pay the city five per cent. of its gross receipts, and the ordinance, with the compensation clause, was passed.

ELECTRIC RAILWAYS.

Surveys have been made for about three miles of the electric street railroad to be built by the Jackson (Miss.) Railroad and Light company. Construction is to be begun at once.

A company has been incorporated with a capital of $150,000 to construct an electric railway from Cumberland, Md., through the mining region, 28 miles, to Westernport.

It is reported that the Raleigh (N. C.) Electric Railroad company has made arrangements to extend its trolley system and that the city authorities will assist in building the line.

Arrangements are being made for the proposed street railroad line on the Metaire road, in the suburbs of New Orleans. R. M. Wamsley is president of the railroad company.

In discussing the assertion that overhead trolley wires in city streets endanger the lives of horses, the Electrical Review of London says: "It takes precious little current, anyway, to kill a horse, and if public convenience is preferred the horses must either go off the streets altogether or take the risk. The average horse would, we think, prefer to take the one-in-a-million chance of being shocked to death rather than the one-in-a-hundred chance of being worked to death on a tramway in a couple of years."

A writer in the New York Times, in speaking of the commercial development of the electric street railway in this country in the last ten years, says that of the electrically operated street railways in this country in 1896, 25 roads showed gross receipts of over $1,000,000 each, while 17 others enjoyed gross receipts between $500,000 and $1,000,000 each. The same writer says that apprehension was felt a few years ago that the trolleys would cut into the business of the steam lines, and now the sounder judgment is that electricity will ultimately replace steam power upon interurban railways.

TELEGRAPH.

An ordinance has been introduced in the Chicago City Council granting permission to the Printing Telegraph News company to construct and operate in the streets and alleys and under the Chicago River, within the south line in Twelfth street, the west line in Ashland avenue, the north line in Kinzie street and the east line in Michigan avenue, a line or lines of wires or electrical conductors for the transmission of sound, signals and characters by means of electricity and a line or lines of pneumatic tubes. The franchise runs for 25 years and contains no compensation clause. John P. McGeorty is attorney for the company. He says the company has been operating for several years furnishing sporting news to its subscribers, and that now it desires to extend its service.

At the coming fast sending telegraphic tournament at the electrical exposition in Madison Square Garden, New York, in May, handsome medals or badges, with liberal cash prizes added, will be awarded to the victors. The events so far arranged will include: A message class for receivers, transmission 30 minutes, receivers to use typewriters of their selection; novice class, open to persons not having an official record, sending five minutes; championship class, open to all, sending five minutes, with prize [illegible]; ladies' class, free for all, sending five minutes; 240 word class, open to those not having an official record of 240 words or better, sending five minutes; 235 word class, open to all who have not an official record of 235 words or better, sending five minutes; 230 word class, open to all who have not an official record of 230 words or better, sending five minutes; 225-word class, open to all who have not an official record of 225 words or better, sending five minutes. An entrance fee of $2 will be charged. Thomas A. Edison is taking great interest in this tournament, as he always does in such affairs, and he will make a phonographic record of the best transmissions, noting the exact time of the revolution of the machine so that perfect reproductions can be made at any future time. The contestants will thus be enabled to have an exact record of their own work, which they can listen to whenever they feel so disposed.

TELEPHONE.

A telephone system is proposed at Griffin, Ga., and E. W. Coleman is mentioned as interested in the project.

At Dawson, Ga., telephone extension lines are being considered. B. D. Menser is actively identified with the movement.

A. S. Lindstrom of Willows, Cal., is building a telephone line from Willows to Elk Creek, Cal., connecting with the Sunset Telephone and Telegraph company at Willows.

J. C. Hubinger of Keokuk, Ia., announces that the City Council of Minneapolis has granted the Mississippi Valley Telephone company a franchise to erect and maintain a telephone exchange in that city. A canvass made before the franchise was asked for brought 4,000 five-year contracts with subscribers for telephones. The same company has also been granted a franchise in Muscatine, Ia., for an exchange there, and it will soon begin work on both of these exchanges. It also intends to extend its toll lines this season to quite a large extent, meeting and connecting with other independent systems.

POWER TRANSMISSION.

A syndicate of New York and Saratoga capitalists has purchased at a cost of $60,000 the land in the vicinity of Hell Gate Rapids on the upper Hudson, about seven miles above Glens Falls. The intention is to utilize the great water power at the place for an electrical plant. A dam and power house are to be erected, and with the electricity generated therein a railroad, to be known as the Saratoga Northern, running between Saratoga Springs and South Glens Falls, will be operated. This road will have branches to intermediate places and also to Glens Falls, Sandy Hill and Fort Edward.

There are good prospects that another canal will be built to divert a portion of the water of the upper Niagara River from its natural course, to be used for power and other purposes. This time Lockport, Niagara County, N. Y., hopes to benefit by the project, and recently the contract was signed by the mayor and city clerk on behalf of the city and by the presidents of the Niagara, Ontario and Lockport Power company and the Lockport Water and Electric company for a supply of 15,000,000 gallons of water daily for 10 years at an annual cost of $50,000. Lockport has always been lacking in a proper water supply, and it is authorized to enter into a contract for a supply by an act of the Legislature. The contract was made no doubt as an encouragement to the companies owning the canal and power franchises to enlist capital sufficient to carry out the project. The canal must be finished and water ready for delivery by May 1, 1904, or the contract will be without effect. At present the manufacturers of Lockport are dependent on the Erie canal for their power supply to a great extent, and this supply is very fickle, as at times the water is shut out of the canal, thereby forcing the plants to shut down or operate by steam. The canal it is proposed to build would have a length of about 20 miles, and probably tap the Niagara River between La Salle and North Tonawanda.

A bill has been introduced in the New York state Legislature providing for the incorporation of the Genesee Power company with a capital stock of $3,000,000, with power to increase to $12,000,000. Among the incorporators and directors are William A. Boland of New York, Cassius M. Wicker of the banking firm of Holins & Co., representatives of the Baring Brothers, New York; Theodore W. Myers, banker, formerly controller of New York city, and George H. Keller, capitalist, of New York. This company proposes to revive the Genesee River storage-dam project in a new form. Heretofore it has been advocated as a state work, but it is now proposed that private capital take hold of the scheme and develop it. It is understood that the water right owners and millers of Rochester are a unit in support of the bill, which provides for the building of a dam in the upper Genesee River, near Portage, and the consequent sale of water and water power. Portage is about 57 miles from Rochester. It is stated that one year when it was very dry the river for several months furnished only 5,500 horse power, while with a storage dam the minimum would be not less than 30,000 horse power. It is also thought that very material sanitary results would be accomplished in Rochester, not only by keeping clear the bed of the river from Main street to the Upper Falls, but also by increasing the flow of the lower river, now badly polluted by sewage.

ELECTRICAL SECURITIES.

The North Shore Traction company reports gross earnings for January of $98,864, an increase of $6,159 as compared with the same month of last year, and net $34,477, an increase of $10,006.

The New Orleans Traction company reports gross earnings for January of $107,222, an increase of $5,963 as compared with the same month of last year, and net $44,157, an increase of $12,930.

Application is to be made shortly to list on the Philadelphia Stock Exchange securities of the United Traction company of Pittsburg, $17,000,000 common stock, $3,000,000 preferred and $4,725,000 five per cent. bonds.

The Columbus Street Railroad company reports gross earnings for February of $47,601, an increase of $4,807, as compared with the same month of last year, and net $24,263, an increase of $1,487. For the two months ended February 28th the gross earnings were $101,389, an increase of $11,726, as compared with the corresponding period of last year, and net $52,861, an increase of $6,988.

MISCELLANEOUS.

The Crofton Storage Battery company of Chicago has been incorporated by Charles B. Stafford, A. C. Crofton and J. K. Pumpelly, with a capital stock of $25,000.

Caryl D. Haskins suggests that the amount of ash-producing material in coal may be determined by the use of the X-ray and the fluorescope. The density of the shadow of coal of unknown value may be compared with that of a standard specimen.

"How to Become an Electrical Engineer" is a problem that is occupying the minds of many young men to-day who are casting about for a profession. The subject is considered in the pamphlet issued by the Electrical Review Publishing company of New York, containing two essays on the subject and a list of colleges giving courses in electrical engineering.

The French town of Etampes has introduced an interesting novelty by replacing the recording secretary of the Municipal Council with a phonograph. Some of the members of the council objected to the innovation on account of the too great faithfulness of the apparatus in reproducing defective pronunciation and errors of speech, but the majority was in favor of making a trial.

Observations have been made recently, says the Scientific American, to determine the extent and cause of the extraordinary deflection of the magnetic needle which takes place over a vast tract of Central Russia. The line selected for observation was one of about 850 miles between Moscow and Kharkov. The widest aberrations are found to exist in the province of Kursk, the capital of which is about 600 miles south of Moscow. In the southeast portion of this province, about 150 miles south of Tim, the needle is deflected more than 96 degrees, and points almost due east and west instead of north and south.

The "war scare" seems to have stirred up the English government. A London correspondent says: "The consternation created at the time of Prince Henry's visit, when the German warships Deutschland and Gefion suddenly loomed out of the fog without having previously been sighted, has aroused the authorities to the necessities of taking additional precautions, and they are now erecting quick-firing guns and searchlights. At the entrance of Portsmouth harbor there will be a light powerful enough to sweep Spithead, and guns will be so placed that ships entering must pass under their muzzles.

TRADE NEWS.

The Western Electric company in advertising the Simplex tape offers to send samples free to those who desire to use it, stating that the recipients need not purchase until they are convinced of the superior merits of the tape.

The Keystone Electrical Instrument company has appointed W. R. Garton of Chicago agent for this territory, and the Chicago sales office will be in his charge. Similar arrangement has been made with William Kline & Co. of New York, dealers in miniature and decorative incandescent lamps.

The Warren Electric and Specialty company of Warren, O., manufacturer of anti-trust incandescent lamps, is keeping up its fight with vigor. The latest development is a reproduction of the first page of a circular sent out by a trust company, which the Warren company adroitly uses to its own advantage.

In order to provide funds to be used for the purchase of additional apparatus for manufacturing lamps and electrical specialties, the stockholders of the K. & W. company of Pittsfield, Mass., have voted to increase the capital stock. The demand for the Hardy lamp has been steadily increasing, and the K. & W. hangerboard is also proving popular.

The Armour Elevator, Chicago, recently started up a Ball engine, built by the Ball Engine company, Erie, Pa., for electrical purposes. The Eden Musee of Chicago has also installed for lighting a Ball en-

gine, and the Bristol Gas and Electric Light company of Bristol, Tenn., has installed a 200 horse power Ball cross-compound condensing engine built by the Ball Engine company.

Secretary and Treasurer Frank G. Scofield of the Bossert Electric Construction company of Utica, N. Y., called at the office of the Western Electrician last week. Mr. Scofield's trip to Chicago was partly to select a western representative, with the view of opening a branch of his business, with Chicago as a center. The Bossert company has already made itself felt in the West, but Mr. Scofield for a long time has felt the need of a personal representative on the spot.

The Electric Appliance company is anxious to emphasize the fact that it is agent for a commercially successful electric soldering iron. The company has now been handling the irons of the American Electrical Heater company for about two years, and in not a single case have these devices been unsatisfactory. The Electric Appliance company is willing to show its confidence in these goods by guaranteeing every iron it sends out to do its work in an entirely satisfactory manner.

The Davis & Egan Machine Tool company of Cincinnati, O., has just received an order through its Amsterdam office for several lathes, shapers and heavy screw machines, to be used by the Holland government. It has also received through its London office orders for lathes, drill-presses, planers and shapers for Greenwood & Batley, machine tool builders and government contractors at Leeds. Business in this country is also improving, the company having secured a number of large orders here in the last week.

President Charles M. Proctor of the Proctor-Raymond Manufacturing company of Buffalo, N. Y., visited Chicago last week. Mr. Proctor is pushing a line of electric bells that contain a number of valuable novel features. The Proctor-Raymond Manufacturing company has done excellent work in the matter of introducing its product throughout the United States, and Mr. Proctor is now on an extended business trip; after leaving Chicago he will work his way through the larger cities back to Buffalo.

On March 3d Judge Fish of Milwaukee refused to set aside the judgment obtained by the American Rheostat company of Milwaukee against the Cutler-Hammer Manufacturing company. The judgment was obtained before Judge Fish by default, and the court estimated the damages at $5,000, one-half the amount prayed for in the complaint. The Cutler-Hammer company made statements to its patrons, and patrons of the Milwaukee company, it is alleged, which were derogatory to the Milwaukee company. Circulars of the same import are alleged to have been distributed among the trade. The Cutler-Hammer company a short time ago made application to Judge Johnson to have the judgment set aside.

The Card Electric company of Mansfield, Ohio, has added quite an extension to its offices and is also making large extensions to its present shop and foundry. When these improvements have been completed the company will be in a position to handle orders with promptness, and the changes will also facilitate materially the building of the larger and heavier designs of electrical apparatus. These extensions are due to the fact that the company anticipates a greater output during this and the coming year than in the past. The Card Electric company has also issued under recent date a neat and handsome catalogue with illustrations and descriptive matter of new designs in direct-current slow-speed multipolar dynamos and motors, for both belted and direct service, and will be pleased to supply copies of it on application.

In about two weeks the Bullock Electric Manufacturing company will commence the erection of its new plant in Norwood, Ohio, about four miles from Cincinnati. The contract for the steel structural work has been let, and bids for the engines, boilers, etc., are now being received. This plant will consist of a large machine shop, brass foundry, pattern and office building and power house, and will have four or five times the capacity of the present Bullock plant. The company is ordering many new machine tools, and its shop will contain the finest tools in the market, as well as the latest electrical apparatus. In nearly all cases each tool will have a motor directly attached to it, reducing belting and shafting to a minimum. It is the desire of the company to make this a model plant, and it will no doubt contain many new and interesting features.

BUSINESS.

The Diamond State Tube company, Elsmere, Del., has recently put on the market a waterproof, fireproof tubing for electrical installation which is meeting with ready sale. This product is claimed to be superior to anything heretofore used and cheaper. Samples and prices may be had on application.

Huebel & Manger of Brooklyn are selling 50 per cent. more of their skeleton fire-alarm and signal bells than they did a year ago. This shows that the trade appreciates the fact that a bell used for such important purposes must be capable of doing every test. The Huebel & Manger bell has a good record of six years' duration and is fully guaranteed.

The Pennsylvania Line has placed in service on its night trains between Chicago and Cincinnati Pullman compartment cars, thus improving its already excellent accommodations between Chicago and the Ohio River. For space apply to ticket agents Pennsylvania Lines, No. 248 Clark street, Auditorium Hotel, No. 221 Michigan avenue, or Union Passenger Station, Canal and Adams streets, Chicago.

The Hunter Fan and Motor company of Fulton, N. Y., is making extensive preparations for the coming season's work. This company has made a specialty of prompt deliveries, and it is the intention that this season shall in no wise differ from the past in this regard. The company's '98 direct and alternating-current ceiling fans are now ready for delivery, and a large number of orders have already been placed.

The W. E. non-sparking brush has proven to be one of the best preventives of the disastrous sparking which so frequently interferes in the successful operation of a dynamo. It is now being used in almost every city in the United States. A circular giving regular stock sizes and price-lists of these brushes will be mailed by the Western Electric company to anyone desiring the information.

Steel gears and pinions form the subject of a small pamphlet, well illustrated and daintily printed, issued from the press of the General Electric company, under the title, "A Modern Gear Plant." It contains a description of the extensive plant which that company has established at the river works at Lynn for the exclusive manufacture of steel gears and pinions, and which has been equipped throughout with the most modern machinery. This pamphlet will be sent on application to any of the company's sales offices, one of which is found in every large city in the United States.

The Walker company will shortly install two six-pole, 100-kilowatt lighting generators in the Metropolitan Museum of Art in New York. The Presbyterian Hospital has also placed an order with the company for a 100-kilowatt generator and switchboard. A Walker alternator, three-phase, 60-cycle, for lighting and power has been purchased by C. Burkhart of Hudson, Wis., while the Los Angeles Traction company of Los Angeles, Cal., has ordered a 500-kilowatt railway generator of the belted type and a generator panel for the switchboard. Among the electric-railway equipments recently ordered from the Walker company may be mentioned 10 double 3 S equipments with type S controllers sold to the Erie Construction company for the Buffalo Traction company; three double 40 horse power equipments with S controllers, to Isaac A. Walker & Son for the Quakertown (Pa.) Traction company, and two double 3 S equipments for storage-battery motor cars to S. M. Fisher, for the Patton Motor company. The Walker company states that the type "S" solenoid-blow-out controller is the most popular one the company has ever placed on the market. The controller departments of its factories are turning out large numbers of the type S apparatus.

The Utica Electric Manufacturing and Supply company of Utica, N. Y., has recently organized a special department for repair work of all kinds. The principal feature is the repair of armatures, which can be handled up to any size. The company solicits business in this line from any portion of the United States, and will furnish estimates immediately upon any kind of work that may be offered. This department will be under the direct supervision of Herbert A. Abbe, who for six years was foreman of the armature room of the Eddy Electric Manufacturing company of Windsor, Conn. Special tools and equipment have been secured for this class of work. General Manager W. C. Baldis reports that the company has been very busy of late in general constructing work, and recently contracts have been obtained for the furnishing of a large number of isolated plants in northern New York and the Thousand Islands. A recent contract received from S. S. Spaulding of Buffalo, to equip his large private residence at Otsego Lake, was sought after by a number of electrical concerns. An order for a 500-light plant for Masonic Temple at Utica, the construction work for the new knitting mill and the Sherborn knitting mill of Utica, and also the contract for furnishing the lighting installation for the village of Oriskany, N. Y., where large Eddy machines will be used, will keep the Utica company very busy for the present.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued March 1, 1898

599,718. Plate for Accumulators. Wilhelm Majert, Grunau, Germany. Application filed August 19, 1897.

An accumulator plate comprising the bar having corrugations therein of the shape of the half of a cone when divided on the line of its axis.

599,742. Apparatus for Visible Signaling. Leopold Sellner, Vienna, Austria Hungary. Application filed March 28, 1896.

A signal light is provided with electrical appliances adapted to render it visible or obscure and an electric circuit including the appliances.

599,766. Insulated Railway Joint. Peter Clark, Philadelphia, Pa. Application filed May 21, 1897.

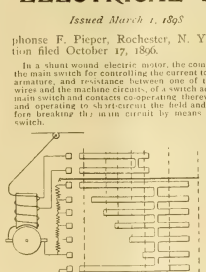
Two ties are connected by blocks of equal thickness halved into the ties, so that the upper and lower surfaces thereof will be flush with the upper and lower surfaces of the ties, two chairs are placed thereon, each of which has formed therewith a stay-plate, and means for securing the chairs and rails in place are provided.

599,789. Transformation of Alternating Currents into Direct Currents. Adolph Muller, Hague, Germany. Application filed July 30, 1897.

In the mode of transforming alternating into direct currents, electrically connecting a shunt circuit with the alternating current circuit before the interruption of the electrical connection between the latter circuit and a discharge circuit, maintaining the connection between the alternating current and shunt circuits during the period of interruption and generating in the shunt circuit a counter-electromotive force, which at any moment of the period of interruption will be substantially equal to the electromotive force of the alternating current, whereby at the moment of the interruption the primary circuit will be without current.

599,791. Electric Motor. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Application filed October 17, 1896.

In a shunt wound electric motor, the combination with the main switch for controlling the current to the field and armature, and resistance between one of the leading-in wires and the machine circuits, of a switch actuated by the main switch and contacts co-operating therewith arranged and operating to shortcircuit the field and armature before breaking the main circuit by means of the main switch.



NO. 599,806.

599,891. Toll-collecting Device for Telephones. Charles E. Scribner, Chicago, Ill. Application filed July 26, 1897.

The combination is claim 1 with a coin-chute provided with a socket for a coin, of a finger adapted to grasp the coin when in the socket, means for releasing the coin from the pressure of the finger and a signal-sounding device operated by the finger when released.

599,803. Rheostat. Sidney H. Short, Cleveland, O. Application filed May 14, 1897.

In a rheostat for street-railway motors, a spider having radial arms adapted to receive the resistance material in spiral convolute layers therebetween, and means for attaching the motor circuit terminals to such resistance material.

599,804. Method of and Means for Controlling Electric Motors. Sidney H. Short, Cleveland, O. Application filed May 19, 1897.

The method consists in maintaining constant or uniform accelerating current until the desired speed has been attained, and thereafter reducing the current, thereby maintaining a uniform speed.

599,805. Method of and Means for Controlling Electric Motors. Sidney H. Short, Cleveland, O. Original application filed May 19, 1897. Divided and this application filed October 21, 1897.

The method of controlling motors consists in varying the windings of the motor held to maintain a substantially uniform accelerating current, and thereafter reducing the motor current to a point such as to maintain a uniform speed.

599,806. Method of and Means for Controlling Electric Motors. Sidney H. Short, Cleveland, O. Original application filed May 19, 1897. Divided and this application filed October 21, 1897.

The method in this case consists in varying the relative connections of two or more motors to maintain a substantially uniform accelerating current, and thereafter reducing the current to a point such as to maintain a uniform speed.

599,807. Pneumatic Controlling Mechanism for Electric Railway Cars. Sidney H. Short, Cleveland, O. Application filed November 13, 1897.

A controller is provided for each car in a train, fluid pressure mechanism for simultaneously actuating the con trollers, and means mounted on each car of the train for controlling the fluid-pressure mechanism.

599,810. Alternating-current Motor. William Stanley, Pittsfield, Mass. Application filed May 9, 1896. Renewed November 17, 1897.

An inducing member is provided with a set of contiguous polar faces of one magnetic phase, and a set of polar faces of a different magnetic phase presented to the induced member so that the resulting fluxes are complanar, each of the sets containing poles of opposite signs.

599,815. Varipolar Motor or Dynamo. Henry H. Wait, Chicago, Ill. Application filed August 20, 1896. Renewed July 29, 1897.

A plurality of independent armature windings and separate commutators for the independent windings are described.

599,818. Electric Arc Lamp. Ernest P. Warner and Henry H. Wait, Chicago, Ill. Application filed March 16, 1897.

The arc lamp has a chimney of insulating material by which the lamp is supported; ducts therein are adapted to receive and protect the carbon or feed rod and the conductors leading to the lamp, and a hood or canopy is adapted to protect the insulating chimney from moisture.

599,828. Electric Railway. William M. Brown, Johnstown, Pa. Application filed October 7, 1897.

A traveling magnetic closer having a compound winding comprising a winding receiving a shunt current from the main circuit, and a second winding receiving a current from the main circuit only when the current is passing to the motors, in combination with an independent source of current supply, and means for passing current therefrom through the second winding when the main-circuit voltage falls abnormally.

599,832. Warp Stop-motion for Looms. Charles Crompton, Worcester, Mass. Application filed July 28, 1894.

A series of warp detectors is adapted to be sustained by the unbroken warp threads, and a support is required for the detectors, a contact into electrical engagement with which the detectors are moved by the breakage of their respective threads, an electro-magnet in circuit with the contact, an armature therefor, a stopping mechanism for the loom controlled thereby and including a rotatable shipper-shaft, mechanism operated by the electro-magnet to move the shipper-shaft slightly, and a spring to quickly complete the movement of the shipper-shaft to stop the loom.

599,862. Electrically Propelled Vessel. Daniel O'Flaherty, Kansas City, Mo. Application filed May 12, 1897.

A vessel is provided with electric motors mounted in casings and adapted to engage the extensions, the motors being in electrical connection with the pilot-house, and the vessel being provided with an electrical steering mechanism which is also in electrical connection with the pilot-house.

599,867. Telephone Transmitter. James H. Rogers, Bladensburg, Md. Application filed March 9, 1897.

In a telephone transmitter there is the combination with a fixed electrode, of a movable electrode mounted thereon and having a projection entering the fixed electrode to hold it in place on the latter, and an elastic conical or skirt-like sounding-board or target depending from the movable electrode

599,868. Electric Car Trolley. William H. Russell, Newcastle, Canada. Application filed April 18, 1896.

The block or frame is connected to the trolley arm to be movable laterally therewith.

599,880. Electric Arc Lamp. Christian Tepel, Bennett, Pa. Application filed December 31, 1896. Renewed January 27, 1898.

An arc lamp is provided with an electro-magnetic feeding mechanism and a vertically movable slotted tubular holder for the upper carbon, in combination with a mechanical feeding mechanism provided with a slotted tubular holder for the lower carbon, pivoted dogs having heads located within the tubes, a longitudinally adjustable connection between the two feeding mechanisms for effecting a positive differential feed, whereby the arc is maintained at the one point.

599,881. Magnetic Closer. Joseph N. Thomas, Johnstown, Pa. Application filed October 19, 1897.

A magnetic closer having an extended pole is adapted to supply a substantially continuous magnetic field throughout its length, and is composed of a plurality of sections insulated from each other.

550,891. Electric Contact Device. John L. Buchanan, Johnstown, Pa. Application filed February 4, 1897.

An electric contact device comprising a plurality of pairs of contact makers having upper flanges, each pair being adapted to surround the conductor, means for yieldingly pressing the flanges of the contact-makers of each pair together above the conductor, and a common frame upon which the contact-makers are secured.

599,892. Electric Regulator for Dynamos. William H. Chapman, Portland, Me. Application filed February 10, 1897.

The solenoid has a movable iron core, and is composed of four distinct coils of wire arranged to oppose each other and to balance each other's magnetic and mechanical action on the core, and to thereby neutralize each other's effects whenever an even number of them is in action, and to pull the core one way or the other when an odd number of them is in action, a set of electrical contacts arranged to open and close the electrical circuit through one of the coils and so unbalance the opposing force and thereby to cause the movement of the core, and a rheostat whose arm is arranged to be operated by the movement of the core.

599,910. Incandescent Electric Lamp. John T. Lister, Cleveland, O. Application filed October 2 1897.

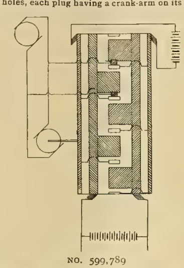
A bulb is provided with two filaments and two pairs of terminals the filaments being placed side by side, a base, and circularly shaped spring contacts therein, one of the contacts being shorter than the other, whereby the shorter contact will engage only one terminal at a time, and means for rotatably securing the bulb to the base.

599,913. Electric Motor. Edmund McNerney, Pittsfield, Mass. Application filed May 22, 1897.

A compound wheel is mounted upon the fly-wheel axle, and consists of insulating and non-insulating material, a shaft mounted on the frame, a double-pronged brush mounted upon the shaft, and means for projecting either prong against the compound wheel and for holding the same in contact therewith.

599,918. Motor Casing. Sidney H. Short, Cleveland, O. Application filed February 16, 1897.

The two-part casing has the field cores on its inner surface, and in its ends bearings for the armature shaft, both of the ends of the lower half of the casing having in line with the end of one of the field cores near its lowest point inspection holes and removable screw plugs for closing the holes, each plug having a crank-arm on its outer end.



NO. 599,789

599,929. Quick-break Switch. Harry P. Davis, Pittsburg, Pa. Application filed July 22, 1897.

A quick-break switch comprising a pair of stationary jaw terminals and a pair of spring plates or strips, the space between which is contracted at or near their outer ends, in combination with a blade having a tongue extending along its inner edge and provided with a head at its free end which engages with the inner faces of the spring plates or strips.

599,930. Switch for Electric Circuits. Harry P. Davis, Pittsburg, and Ernest F. Harder, Wilkinsburg, Pa. Application filed October 28, 1896.

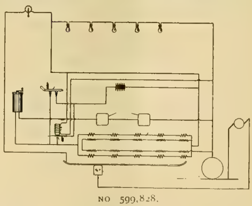
A switch for electric circuits comprising a stationary jaw terminal and a movable blade having spring plates or washers riveted to its sides, the outer side faces of which make contact with the stationary jaw terminal.

599,931. Electric Arc Lamp. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa. Application filed August 22, 1896.

A dash-pot for arc lamps comprising a cylinder and a plunger, one of the parts being stationary and the other longitudinally movable, in combination with a yielding, resilient cushion for the stationary member which permits lateral movement of the member from its normal position, but tends at all times to restore it to such position.

599,932. Method of and Apparatus for Regulating Electric Motors. Budd Frankenfield and Dugald C. Jackson, Madison, Wis. Application filed January 28, 1897.

The method described of varying the speed of a multipolar motor consists in weakening and strengthening the magnetomotive force due to the coils exciting one or more of the poles, while leaving the magnetomotive force due to the coils exciting one or more of the poles unchanged.



NO 599,828.

599,940. Non-synchronous Electric Motor. Benjamin G. Lamme, Pittsburg, Pa. Application filed April 30, 1894.

A rotary field motor is described, having a primary member provided with a distributed winding located beneath the surface of the core and in proximity to the adjacent surface of the secondary member, the coils of the winding being superposed and severally embracing a peripheral core space which differs from that obtained by dividing the whole circumference by the number of poles.

599,941. Direct-current Electrical Machine. Benjamin G. Lamme, Pittsburg, Pa. Application filed May 8, 1896.

A field magnet having inwardly projecting pole pieces is provided with relatively narrow magnetic pole shoes which project laterally from the pole faces, and serve to increase the width of the fringe of the magnetic field.

599,942. Inductor Dynamo. Benjamin G. Lamme, Pittsburg, Pa. Application filed July 12, 1897.

A magnetizing coil is provided with a magnetic circuit having a relatively wide air-gap and a relatively narrow air-gap, in combination with a set of generating coils adjacent to the wide air gap.

599,943. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa. Application filed September 18. 1897.

Means are provided for varying the electromotive force of a work-circuit in accordance with changes in load comprising an auxiliary generator having a series field-magnet winding and a separately excited winding, in combination with an exciter for the latter having a field-magnet winding which is traversed by the feeder current.

599,947. Electrically Propelled Vehicle. Philip R. Salberg, Pittsburg, Pa. Application filed February 5, 1896.

The vehicle is provided with an overhead trolley, and means for simultaneously applying the brakes and pulling down the trolley when the latter leaves the supply conductor, the means being controlled by the upward movement of the trolley above the conductor.

599,954. Switch for Electric Circuits. Gilbert Wright, Wilkinsburg, Pa. Application filed September 18, 1897.

A double-throw switch comprising stationary socket terminals, co-operating plungers and a pivoted operating lever having arms provided with cams for engaging and actuating the plungers alternately in opposite directions.

599,975. Portable Electric Lamp. Leonard Paget, New York, N. Y. Application filed July 8, 1897.

An electric lamp consisting of a case comprising two parts of conducting material insulated from each other and covered with external insulation, a lamp supported upon the case and electrically connected thereto, and a battery within the case, one of its terminals being in engagement with one part of the case, and the other adapted to be connected with the other part thereof by means of a movable circuit closer.

600,037. Weighing Machine. Francis H. Richards, Hartford, Conn. Application filed July 8, 1897.

The weighing mechanism described embodies a load receiver provided with a closer, a supply conveyor, driving mechanism for the supply conveyor, the driving mechanism including an electrical motor, an electric circuit embodying a device for governing the action of the motor, and a controller in the circuit and in position to be actuated by the closer, thereby to effect the operation of the device which governs the action of the motor.

600,057. Rheostat and Electric Heater. Henry P. Ball, Brooklyn, N. Y. Application filed October 30, 1897.

The ribbon-like conductor is disposed edgewise between two plates, and there is a layer of adhesive material on each plate in which the conductor is partially embedded and by which the conductor is attached to the plates.

600,058. Flexible Electric Conductor. Antoine Bournonville, Philadelphia, Pa. Application filed November 20, 1897.

A flexible electric conducting cord having a single central section and two or more terminal sections at one end, a fabric covering for the cord extending continuously over the single section and the terminal sections.

600,063. Strain Insulator. Henry Carmichael, Malden, Mass. Application filed June 13, 1895.

This strain insulator is composed of interlocking metallic members, an interposed body of insulating material incompressible at substantially the temperature and tension of use specified, an enveloping mass of insulating material compressible at the temperature and tension of use, and an inclosing jacket for the compressible insulating material.

600,073. Telegraph Cable. John J. Hall, Slough, England. Application filed October 4, 1897.

An electric telegraph cable is composed of a plurality of conductors, each provided with a wrapping of a netted textile fabric secured thereon by a spirally wound textile thread or yarn, the conductors being laid in a bunch in the form of a cable, and a textile cord wound spirally around the whole.

600,088. Current Collector for Dynamo-electric Machines. George W. Nell, Philadelphia, Pa. Application filed February 23, 1897.

In a current collector for dynamo-electric machines the combination is described of the armature coils, current distributers, one or more magnets located above the collector, levers rotating with the armature and controlled by the magnet or magnets, and contact devices operated by the levers, whereby the connection of the opposite ends of the armature coils with the current distributers will be effected at the proper time, and both connections will be made at the top of the collector.

600,092. Electrically Operated Hoisting Machinery. Alton J. Shaw, Muskegon, Mich. Original application filed May 6, 1893. Divided and this application filed January 16, 1894.

Claim is made for the combination with trolley and with hoisting beam, tongs carried by the beam, motor for actuating the tongs, insulated conductors extending lengthwise of the beam and connecting with the motor, brushes or contact pieces carried by the trolley and arranged to maintain contact with the beam under varying adjustments of the latter, and a switch also carried by the trolley and serving to control the supply of current to the motor.

600,101. Supply System for Electric Railways. David Urquhart and Frank Wynne, London, England. Application filed February 25, 1897. Patented in England January 25, 1896.

In apparatus for supplying electricity to electrically propelled vehicles there is described the combination with switches for connecting a main conductor with successive road contacts, of electro-magnetic switch-operating devices, each having its winding in connection with a condenser, and a traveling alternator adapted to complete the circuit of the successive electro-magnetic devices through the corresponding condensers.

600,112. Electric Switch. James J. Flint, Denver, Colo. Application filed February 16, 1897.

The first claim is given: In an electrical switch, the combination with an insulating base, a cap-plate and push-buttons, of a lever-like circuit-closing arm adapted to be actuated by the push buttons, a support attached to the base and upon which said arm is fulcrumed, a roller attached to one extremity of said arm, a keeper also pivoted on said support and located adjacent the roller extremity of the arm, said keeper carrying a roller adapted to engage the roller of the said arm, and a coil-spring connecting the keeper with the stationary support, and suitable contacts which the circuit-closing arm is adapted to bridge.

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Snoqualmie Falls Transmission.

Work has been begun on an important power-transmission plant to connect Snoqualmie Falls, in the Snoqualmie River, state of Washington, with the cities of Seattle and Tacoma. Snoqualmie Falls is a very impressive cataract, as will be seen by the accompanying picture, with an unbroken fall of 270 feet. It is about 25 miles east from Seattle and about 35 miles northeast from Tacoma. At low water the power in sight is estimated at 20,000 horse power, but this can be largely increased at comparatively small expense by the construction of a dam, creating a storage reservoir, for which the topography of the country is well adapted.

The Snoqualmie Falls Power company (capitalized at $500,000), which has the work in hand, proposes to install an initial plant capable of delivering 5,000 electrical horse power at the cities named. It will sink a shaft at the edge of the river, about 350 feet above the brink of the cataract, to a depth of about 250 feet. This shaft will be eight by 25 feet in horizontal dimensions and will be large enough to pipe down water capable of exerting a force of 10,000 horse power. The type of water-wheel has not been decided upon, but there will probably be three or four large units of about 2,000 horse power each. The water-wheels will be directly coupled to large generators, probably of the three-phase type, and it is likely that two dynamos will be attached to each water-wheel, one on each side, to make a generating unit. An interesting feature of the plant, as now proposed, is the fact that the generators as well as the water-wheels are to be placed in the cavity at the base of the shaft. The entire power plant, with its attendants, will thus be 250 feet below the surface of the ground above the falls. Access to this subterranean plant will be gained by an elevator in the shaft. A short tail-race will discharge the water into the lower level of the river.

Step-up transformers on the surface of the ground will raise the electromotive force of the current from the generators to a line potential of about 16,000 volts. At this pressure the current will be transmitted over pole lines to Seattle and Tacoma. At a distance of about 20 miles from the power plant the main line branches, one set of wires going to Seattle and one to Tacoma. The pressure will be reduced in sub-stations in the cities, and the power will be sold for various industrial purposes. The state of Washington produces a large amount of coal, but it is not of such good steaming quality or as cheap as that of the middle West, so that there should be a good demand for electrically transmitted water power at a cheaper price.

A number of Chicago gentlemen are concerned in the project. William T. Baker, ex-president of the Board of Trade, is interested in the company; Thomas T. Johnston is the chief engineer, and Sargent & Lundy are the electrical engineers.

SNOQUALMIE FALLS.

Surveys have been made for a four-mile extension to the Shamokin (Pa.) and Mount Carmel Electric Railway company's system. The proposed line will be constructed this summer and will extend from Mount Carmel to Locust Gap and thence to Locust Dale. At the latter place it will connect with the line of the Schuylkill Traction company, thus affording a continuous trolley line from Shamokin to Shenandoah and Mahanoy City.

Electrical Communication with Coast Defenses.

In a letter addressed to the secretary of war, Gen. A. W. Greely, chief signal officer of the army, again calls attention to the need of electrical communication with fortifications and other coast defenses. He says:

"The estimate of $20,000 for cables to connect electrically the fortifications in the harbors of New York, Boston and Philadelphia has been omitted from the sundry civil bill as reported by the House of Representatives. The chief signal officer would be derelict in his duty did he not call the attention of the secretary of war to the necessity of urging upon the Senate such an appropriation. For seven consecutive years the chief signal officer has unavailingly recommended the importance of this matter, reciting the fact that some of our most important defenses can only be reached by messenger.

"The destruction of the military cables between Alcatraz, Angel Islands and the mainland long since left the fortifications in San Francisco isolated and entirely unconnected electrically, and Fort Warren in Boston harbor is also without reach by telephone or telegraph. In New York harbor it is true that several posts can communicate with each other over circuitous commercial routes, but such complicated methods, inadequate in peace even, would inevitably break down in case of actual hostilities.

"These estimates have been recommended both by you and former secretaries of war, have been repeatedly urged as military necessities by the commanding generals of the departments affected, and have been heartily approved by the commanding generals of the army.

"Never more than to-day have time and co-operation been more noted elements of strength, whether in the industries of peace or the art of war. In the business world the most acute minds of the century are applying themselves to the development of speedy and increased communication, especially through electrical devices, and the failure of any country to utilize in this direction the highest inventive skill must materially lessen its chance of success in war. In every other country of the world the entire system of harbor defenses for each port is connected electrically, so that not only is intercommunication and the transmission of orders constantly maintained, but the fire control and the direction of the defense rest under one master mind.

"It must seem hardly credible to either business men or to experts that Congress after authorizing a system of coast defenses to cost millions of dollars should for years refuse to connect the military forts around the great cities of New York, Boston and San Francisco, either electrically or telephonically. In critical emergencies, such as arise in all defenses, military operations at these points would, under existing conditions, be necessarily conducted without concert or unison, thus needlessly jeopardizing lives by the thousands and property to the value of hundreds of millions of dollars.

"The present situation is parallel to that which would exist if our great cities, after spending tens of thousands of dollars in thoroughly establishing a fire department, should refuse to install therewith an electrical signal system and insist that alarms of fire should be sent either by messengers or by the nearest commercial telegraph line."

A late press dispatch states that General Greely has been given authority by the secretary of war to proceed without regard to ordinary restrictions in establishing rapid telegraphic connections between the sea-coast fortifications. It will not be necessary, therefore, to invite proposals for furnishing supplies and to follow the ordinary methods of procuring the telegraph material and doing the work. The rather extraordinary authorization was conferred upon General Greely after the forcible presentation given above. It is shown that even in New York harbor, where the War Department has devoted its best energies to the perfection of the fortifications, it requires three-quarters of an hour to pass a message from one battery to another. Fort McHenry, Baltimore, is worse off; while, strange as it may seem, the only method of communicating between the national capital and its most important defensive work, Fort Washington on the Potomac, is by means of a messenger.

The city of Higginsville, Mo., has sold a franchise to an independent telephone company, and it is expected that an exchange will be built in that city shortly.

O. O. Wiegand, manager of the Northeastern Wisconsin Telephone company of Shawano, Wis., announces that the company will extend its line from Angelica to Green Bay, Wis. Other extensions are also contemplated.

Protecting Inlet Canals at Niagara Falls.

By Orrin E. Dunlap.

At this time of year, when the great ice fields in Lake Erie are breaking up, immense quantities of ice pass down the Niagara River, requiring the power companies to be especially watchful of the water service through their canals. When the wind brings the ice of the lake toward the entrance to the Niagara River, it is remarkable what an immense amount of the ice enters and passes down stream to the falls. It is recorded in history that 50 years ago, on March 29th, this flow of ice was so great at Buffalo that it blocked the entrance to the river, so that for several hours no water passed in from the lake, and the great Falls of Niagara went dry for hours. Many are the stories told of the strange spectacle and of the weird sights that then presented themselves to the view of the residents of the Niagara locality of that day. Never since, however, has anything quite like that happened and the flow of water has been constant. Every winter the ice lodges in great fields on the bars in the upper river, but this has not served to interfere with the water supply of any of the great turbines.

It will be recalled that the entrance to the inlet canal of the Niagara Falls Power company is directed down stream in order to avoid the ice difficulty and also to protect it from catching drift of any kind coming down the river. In addition to this the entrance is protected by a timber boom resting against iron piers fastened to the rocky bottom of the canal. This boom is an efficient protector of the canal from ice and all kinds of drift, the confidence in its service being well displayed by the fact that the pulp wood for the big mill of the Niagara Falls Paper company floats down outside of it to the point where it is taken from the water and transferred to the mill yard. Last summer nearly 50,000 cords of this wood so floated by the boom and but a few small sticks entered the canal. Its service is portrayed in the accompanying illustration, Fig. 1, which shows the boom and the iron piers at the entrance to the canal. The service this boom performs in summer is repeated in the winter time, with the exception that in winter the great ice floes are warded off and guided in their course to the falls, there to make the plunge over the precipice and possibly later on to become a part of one of the wondrous ice-bridge formations for which Niagara is famous. Incidentally it may be remarked that this point on the upper Niagara is one of the well patronized bathing places at the Falls during the summer time, the boom affording an excellent resting place as well as a point from which to dive. Racks placed in front of the inlets to the penstocks still further protect the turbines from injury from floating substances.

The entrance to the Niagara Falls Hydraulic Power and Manufacturing company's canal is also protected by a boom in winter, as is shown in Fig. 2, which is slightly lowered at one side to show the direction of the flow of the river. This point on the canal is known as Port Day, and in the summer the boom is removed from the entrance and stored close to the side wall. Its principal use is to keep the floating ice out of the canal. As this canal is 4,400 feet long, more or less ice forms in it, also in the canal basin, but since it has been deepened, the ice seldom gives trouble.

The Hunter Patents of December 21, 1897.[1]

By A. Miller Belfield.

Considerable interest was excited by the appearance in the Official Gazette of December 21, 1897, of three patents to Rudolph M. Hunter of Philadelphia, Pa., for "Improvements in Electrical Transmission of Energy." These patents involve the use of transformers, or, it may be said, the induction of currents for local circuits from high-tension circuits by the use of transformers, and contain claims which appear at first sight to be broad, and perhaps even generic or basic.

Those who follow the development of electrical inventions by glancing over the Gazettes as they are issued were very much interested by the appearance of these patents, and curious to know what effect, if any, they might have upon the electrical industries already organized and employing transformers in the electrical transmission of energy. Those who were immediately engaged either in the use or the manufacture and sale of transformers were no doubt startled by the appearance of these patents, and very likely were more or less anxious as to whether or not the issue of these patents made them infringers of patents, by making or using what had been so generally used so long as to afford good ground for the belief that it was common property.

Some discussion has been indulged in regarding these patents and their status in electrical industries, and I am told there have appeared some articles implying that there existed a relation between these

FIG. 1. PROTECTING INLET CANALS AT NIAGARA FALLS.

Hunter patents and the Tesla patents for electrical transmission of energy, and intimating that they subordinated the Tesla patents.

With the hope of throwing some light upon these questions, I have taken up the consideration of the Hunter patents. I shall first consider the inventions and claims of the patents; next, the breadth or interpretation to which their claims seem entitled in view of the inventions they set forth, and finally what bearing, if any, they may have upon the present electrical industries.

These three patents are No. 596,041, which I shall term Patent A; No. 596,042, which I shall term Patent B, and No. 596,002, which I shall term Patent C. Patent A is assigned to George W. K. Stephens of Philadelphia, Pa., and is the outcome of a divisional application filed October 4, 1889, of an original application filed February 23, 1883. Patents B and C are both assigned to the General Electric company of New York. Both of them also are the outcome of divisional applications: that of Patent B being filed April 20, 1892, from an original application filed June 18, 1887, and that of Patent C being filed July 28, 1891, from an original application filed November 9, 1887.

First, with reference to No. 596,041, or Patent A. This patent shows diagrammatically two forms or arrangements of an apparatus for carrying out the invention which it sets forth. In the first of these (see Fig. 1) there is shown a transmitting station A and two receiving stations B and C. At the transmitting station A an undulatory current is generated in a local circuit 1, including a local battery 2, by speaking to or otherwise actuating a telephone transmitter 3, included in such local circuit. The undulatory current thus developed actuates an electro-magnet 4 included in the local circuit 1, and thereby causes to vibrate an armature 5 which is included in the line circuit 6 and which has its free end arranged opposite the pole of the thus variably energized electro-magnet 4. This armature 5, in vibrating, presses with greater or less force against a carbon block 7, which is likewise included in the line circuit 6, and thereby varies the resistance of such circuit so that a current which is generated in a battery 8, included therein, and which would otherwise be constant and continuous, becomes undulatory. This undulatory line current, upon arriving at the first receiving station B, passes through the fine wire or primary coil 9 of a transformer or induction coil D, and thereby induces a corresponding undulatory current in the secondary 10 thereof. The undulatory current thus induced, together with the current from a local battery 11, which augments it, actuates a telephone receiver 12 arranged in a local circuit 13 which includes the local battery and the secondary of the transformer, and also variably energizes an electro-magnet 14, likewise included in the local circuit 13. The electro-magnet 14, so variably energized, vibrates an armature 15, included in the line and resting upon a carbon pencil 16, and thereby varies the resistance in the line in a way which is said to "augment the currents flowing in the line, greatly increasing the inductive effect and hence the currents set up in the local circuit."

The undulatory current of the line upon arriving at the second receiving station C likewise traverses the primary 9a of a transformer D' located thereat, and in like manner induces a secondary current in a local circuit 13a, including the secondary 10a of the transformer D'. The arrangement of this second receiving station C is similar to that of the first mentioned receiving station B, with the exception that the vibratory armature 15, which presses upon a carbon pencil 16, so as to vary the line resistance, and which is actuated by an electro-magnet 14 at the first station, is actuated by the induction coil or transformer D' itself at the second station.

In the apparatus of the second system of this patent, a generator is employed as a means of producing the line current, instead of a battery, as in the first-mentioned system, and but one receiving station is shown, instead of two, as in the first instance. At the receiving station the line is connected in series with the fine wire or primary of a transformer, and at the receiving station no telephone receiver is shown in the local circuit, but instead, the specification states that any transmitting device may be used.

Thus it will be seen that the patent shows and describes an apparatus involving a line or circuit extending between a transmitting and a receiving station, means for developing therein a constant and continuous current, means at the transmitting station for varying the line resistance, so as to make the constant current undulatory, and at the receiving station a transformer or induction coil having its fine wire included in the line, a local circuit including the coarse wire or secondary of the coil, and a translating device included in the local circuit. The patent contains seven claims, six of which embrace more or less broadly the combination of devices above enumerated, while the seventh covers the method of transmitting electrical energy involved in the operation or employment of such combination, or an equivalent one.

Next, with reference to Patent B (see Fig. 2), a constant-current generator 1 is employed to develop a current in a line circuit 2, extending between a transmitting station A and two receiving stations B and C. This current is automatically interrupted so as to produce an interrupted, intermittent or broken current. In one arrangement of the invention it is interrupted at the receiving stations by means of common magnetic make-and-break devices, while in the other arrangement it is interrupted at the transmitting station by a rotary interrupter on the shaft 3 of the dynamo 1, as shown in Fig. 2. This interrupted or intermittent current is fed to the primaries or fine wire coils 4, 4, of transformers D, D, at the receiving stations B and C, and when thus fed operates to induce alternating currents in the secondaries or coarse wire coils 5, 5, thereof. The currents thus induced are utilized for translating devices, such as lamps, which are arranged in local circuits 6, 6, at the receiving stations B and C.

This patent, therefore shows and describes apparatus involving a line circuit extending between a transmitting station and one or more receiving stations, a constant-current generator which can develop current in the line circuit, means for interrupting the constant current so as to produce an interrupted or intermittent current, induction coils or transformers at the receiving stations, and local receiving-station circuits, including translating devices, such as lamps. The claims, seven in all, of which six are for the combination of devices above enumerated, more or less broadly expressed, while the remaining seven are for the method of transmitting and utilizing the electrical energy involved in the use of the apparatus comprising such combination, or an equivalent one.

Next, with reference to patent C (see Fig. 3). A generator 1 is employed to develop a current in local circuit 2 at the transmitting station A. This generator may be either an alternating-current ma-

1. Read before the Chicago Electrical association, March 11, 1898.

chine or a direct constant-current machine. In the latter case the current is either broken or interrupted, or is reversed; in either case the result is the production of a current serviceable for induction purposes. The current thus produced traverses the secondary or coarse-wire coil 3 of an induction coil D, situated at the transmitting station A, and thereby produces a current higher in potential than the current of the machine. This high-potential current is transmitted through a line circuit 4 extending from the transmitting station A to one or more receiving stations, such as B and C, at which latter it is transformed to lower potential currents by means of step-down transformers E, E. The lower potential receiving station currents thus produced are employed in part for translating devices, such as lamps, arranged in local circuits 5, 5, and are in part re-transformed into high-potential currents by means of step-up transformers F, F, likewise arranged in the local receiving-station circuits 5, 5.

This patent, then, shows an apparatus involving a line circuit extending from a transmitting station to one or more receiving stations, means for developing therein higher potential currents available for induction purposes, one or more step-down transformers which utilize the line current for producing receiving-station currents of a potential lower than that of the line current, a corresponding number of local receiving circuits which receive the low-potential currents thus induced and a corresponding number of step-up transformers which retransform the induced receiving-station currents into high-potential currents at the different receiving stations.

The patent has two claims which these devices more or less broadly set forth.

In brief, such are the Hunter patents. There now arise the questions as to their validity and their interpretation, if valid.

Inasmuch as they have not been adjudicated by a court of last resort, any opinion relating to these questions must, of course, be mere speculation. And as I have not been able to examine the file wrapper and contents of these patents and the art prior to their dates of application, what I have to submit upon these questions must be only such observations as can be based upon the patents themselves.

In these observations I shall refrain from expressing any opinion as to the validity of the patents either for lack of novelty or for lack of invention, although these questions are, of course, open in the present instance, and are by no means inconsiderable. But I shall not discuss them, because, as I say, I have not investigated the prior art, and they depend directly upon it for their determination.

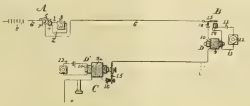

Fig. 1.

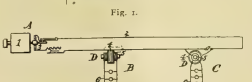

Fig. 2.

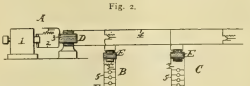

Fig. 3.

THE HUNTER PATENTS OF DECEMBER 21, 1897.

Neither shall I consider the question of inoperativeness of the devices of the patents as a ground for disputing their validity, although there exists in them some few things which seem to afford a basis for assertions to that effect. For instance, it seems doubtful to me that the electro-magnet 14, shown in Patent A, included in the local circuit 13 at the receiving station B and variably energized by the induced current thereat, will vibrate its armature 15 so as to produce vibrations in the line resistance corresponding with those produced in the line circuit 6 at the tran-mitting station A, because of the lag of the induced current behind the inducing current. This lag may be such as to cause the variations produced in the line resistance by the receiving armature to fail to correspond to the undulations of the line current to an extent to practically counteract such undulations. But I shall pass over these questions of novelty, invention and operativeness and attempt to point out what seems to me the construction to which the claims of the patents are entitled, assuming them to be good and valid.

Obviously, in their broadest conception, Patents A and B disclose the combination with a line circuit extending between a transmitting and a receiving station of means operable at the transmitting station for developing in the line currents which can be utilized for induction purposes, and at the receiving station means for transforming the line-inducing current into a current of different potential, and a local circuit which receives this current of different potential and is provided with translating devices adapted to utilize it.

The question undoubtedly is, What scope or breadth is to be given to the means for producing the line current which is serviceable for induction purposes? or, in other words, whether or not the patents can be so construed as to include any and all means for producing a current serviceable for induction purposes, or whether they are to be limited to the precise means they illustrate and describe.

The first six of the seven claims of Patent A, or, in other words, all of the apparatus claims of that patent, have their means for producing the line-inducing current limited to means for producing a current of alternately rising and falling potential, or alternately varying potential, or alternately increasing and decreasing potential, the different terms being used in different claims. The means illustrated and described by Patent A for producing the current which the specification terms a current of alternately rising and falling potential comprises, it will be remembered, a producer of a constant current, such as a primary battery, or a continuous current generator and means for varying the line resistance so as to render the current from such battery or generator undulatory, such means, for example, as a carbon pencil and a vibratory armature making contact therewith, in combination with an electro-magnet included in a local circuit at the transmitting station and variably energized by the actuation of a telephone transmitter, likewise included therein.

All of these six claims, except the fifth, are further limited by a more or less specific reference to this apparatus: the first to means to produce and maintain a continuous current and means to convert it into high-tension currents; the second to a variable resistance; the third to a source of electricity of one sign, and the sixth to a source of positive electricity; and the fourth to a main electric generator and means for operating it without interrupting the current so as to vary the potential, etc. These claims are, of course, limited to the devices which they enumerate. The fifth claim, however, is limited only by the term "alternately increasing and decreasing potential."

The claim is as follows:

5. A line conductor conveying currents of alternately increasing and decreasing potential, a series of local circuits, and corresponding induction coils, each of which has its fine-wire coil energized by the current in the same line conductor, and separate local circuits, each connected with the coarse-wire coil of the corresponding induction coil.

In terms it is broad enough to cover or include a line conductor carrying any variety of current having an alternately increasing and decreasing potential, whether produced by the apparatus shown in the patent or not.

But as the patent neither shows nor describes any other apparatus for producing a line current available for induction purposes, nor contains any suggestion that any other apparatus can be used therefor, there may arise some question as to what it can be considered to cover.

In view of the tendency of the courts to construe claims pretty closely to the apparatus shown in the patent, in the absence of extenuating circumstances, the expression "alternately increasing and decreasing potential" of this fifth claim may be construed by a court as meaning a direct or uni-directioned (as opposed to a true alternating or reversing potential) continuous, undulatory current, such as that produced by the apparatus set forth in the patent; and the claim therefore may be construed so as to cover apparatus for producing such a direct, continuous, undulatory current, and such apparatus only.

Claim 7 of this patent, which is the method claim thereof, is broader than the six apparatus claims, and contains no limitations as to the style of inducing current generated in the line. This claim is as follows:

"The method of transmitting electrical energy consisting in transmitting an electric current of high tension and small volume over a line circuit, and at one or more places on the line circuit, producing, by means of induction, currents of low tension and relatively large volume, and supplying said low-tension currents to one or more translating devices in said local circuits."

This claim, in its terms, includes the method of transmitting currents which are serviceable for induction purposes, transforming them into currents of relatively low tension and large volume, and utilizing the induced currents in local receiving-station circuits, irrespective of the style of line currents which cause the induction and irrespective of the style of induction apparatus employed at the receiving station. It is barely possible, however, that a court, instead of giving it a construction as broad as its terms, may construe it as covering only the method of inducing currents at the receiving station by means of uni-directioned undulatory line currents, as is done by the apparatus of the patent.

All of the claims of Patent B, except the sixth and ninth, contain qualifying terms limiting such of them as are apparatus claims to means for producing what is called a "maintained and practically uniform" current in the line circuit, and limiting such of them as are method claims to the generation and transmission of such "a maintained and practically uniform" current.

Just what the patentee meant by the term "maintained and practically uniform," I confess I am unable to say. Possibly it is meant to indicate that the series of current impulses follow each other in regular succession and correspond to one another in size and character, as would result from generating them by a dynamo-electric machine, in contradistinction to the current impulses which are produced in the apparatus of Patent A, as a result of intermittently or occasionally speaking to a telephone transmitter, and which consequently are irregular or fitful in succession, or even disconnected or intermittent, and are dissimilar or non-uniform in size and character.

This view is submitted only as a suggestion, however, and with not much assurance that it is the correct one. Very likely an examination of the record of the case would show some other meaning was intended. If its import is such as I have suggested, these claims, in their terms, cover or include means for generating, or the generation of, according as they are apparatus or method claims, any variety of current involving a regular series of similar or corresponding impulses. In such case, I take it that they, in effect, include any style of inducing current generated by a dynamo electric machine, for the

FIG. 2. PROJECTING INLET CANALS AT NIAGARA FALLS

reason that regularity in the succession of impulses, and correspondence in size and character thereof, are characteristics of a dynamo-generated inducing current, as opposed to a current generated as a result of the action of a telephone transmitter or like irregularly acting device.

If the meaning of the expression "maintained and practically uniform" is not such as I have suggested, these claims are limited in accordance with the interpretation given to it.

Claims 3 and 4 further characterize the currents of high tension as being alternating currents. As no apparatus is shown for generating what is a true alternating current, this expression, if it does not invalidate the claims altogether, must be considered as intending to describe a pulsatory current, that is, a current which alternately exists and does not exist.

Claims 6 and 9, as I have said, are not limited to the use of "maintained and practically uniform" currents. They contain no limitation upon the style of current generated or the means for generating it; but are respectively, the one for the method of transmitting electrical energy in a line circuit and of utilizing it to induce local currents at receiving stations, and of regulating the line current so as to vary all the currents in the local circuits simultaneously, and the other for apparatus by which this method can be carried out. In terms they are broad enough to include any and all varieties of apparatus for methods of generating currents serviceable for induction purposes, and for regulating the line currents so as to vary all the currents in the local circuits simultaneously.

Like claims 5 and 7 of Patent A, all of the claims of Patent B may not be given an interpretation as broad as their terms, but may, so far as anything now known is concerned, be limited to the apparatus set forth in the specification of the patent.

To summarize, it appears that these patents A and B, in their broadest conception, disclose means for generating and transmitting currents serviceable for induction purposes, means for transforming them into currents of different potential, local receiving-station circuits and translating devices for using these induced currents, and also disclose the method involved in the use of such apparatus; that Patent A contains a method claim as broad in terms as the disclosure and an apparatus claim limited only by the expression "alternately increasing and decreasing," applied to the inducing current, and that Patent B has method and apparatus claims for the regulation of the line current so as to regulate the induced currents simultaneously, unlimited in their terms as to the style of apparatus or current used, and also has claims for the method of and apparatus for generating and transmitting electrical currents and utilizing them to produce induced currents, with no limitation other than the expression "maintained and practically uniform," applied to the style of line-inducing current employed.

The interpretation of Patent C is much less involved. Its two claims enumerate specifically, in combination with the line, the generating apparatus, and the transformers and local circuits at the receiving stations, step-up transformers for utilizing the induced currents at the receiving stations and for transforming them to high-tension currents. There can be found for considerable doubt as to whether or not invention can be predicated upon the use of an additional transformer for stepping-up a current after it has been stepped-down from the line current, when the use of a transformer for producing a current of different potential is known. But given its face value, this patent covers the use of a step-up transformer in a local circuit employing currents induced from a line-circuit current by a step-down transformer.

We next come to the consideration of the bearing of these patents upon the electrical industries of the present time. Upon telephony, I suppose they have little bearing. I believe that telephone apparatus is not used to any extent in the system shown in them. If it is, of course apparatus such as that shown in the patents would be covered by the claims thereof and would infringe the same.

Upon electrical lighting by means of alternating currents and transformers at receiving stations, I presume these patents have the greatest bearing. So far as I am aware, the electric lighting done in this way is by means of one alternating currents, that is to say, current with an alternately reversing potential, and not by means of either undulatory or interrupted currents, such as those developed by the apparatus of these patents.

So if claims 5 and 7 of Patent A are limited to the apparatus of the patent, I apprehend that this patent is not infringed by the manufacture, sale or use of alternating-current apparatus. But if its claims 5 and 7 are given a construction as broad as their terms, every alternating-current plant in the United States infringes both of them, and perhaps every factory in the country would be held to be a contributory infringer of claim 5. Similarly, if the claims of Patent B be limited to the apparatus of that patent, alternating-current apparatus does not infringe it. But if they are construed as broadly as their terms read, claims 6 and 9 are likewise infringed by every alternating-current plant in the country, and perhaps claim 9 by every factory therein, on the ground of contributory infringement, for I suppose that every alternating-current system has its line current regulated so as to simultaneously regulate the induced current at the stations. Furthermore, if the expression "maintained and practically uniform" of Patent B be construed so as to include alternating currents, the same plants likewise infringe claims 1, 3 and 5 of that patent.

If step-up transformers are used in the local circuits of such system, both claims of Patent C are infringed by the persons responsible for such use. I wish to repeat here, however, that I express no opinion as to whether or not these patents will be declared valid and construed in this liberal way. I am merely suggesting what would be the result if they were so treated.

Finally, as to the bearing of the patents, or their alleged bearing, upon the Tesla system of generation and transmission of energy. My understanding of the Tesla system is that it involves, essentially, the production of a rotary magnetic field by the development in independent circuits of alternating currents, differing in phase from one another, and does not in itself involve the use of transformers. In such case, I am unable to see that it and the Hunter patents have any relation or connection or bearing upon one another whatsoever.

If there should be employed in connection with the Tesla system transformers for use in any one of its independent circuits, as I understand is frequently if not even generally done, of course such circuit would be subject to the claims of these Hunter patents in the manner I have hereinbefore indicated with reference to electric-lighting distribution circuits, because the expression "translating device" used in these claims includes motor field magnets as well as electric lamps. But this infringement of the Hunter patents by the users of the Tesla system evidently does not result from the employment of the Tesla system per se, but is merely incidental thereto, just as a similar infringement of the patents might result from the use of transformers in connection with any other system.

From these observations, it appears to me that there is room for a clash between the owners of the Hunter patents and the makers, sellers and users of electric-lighting and other systems employing line-inducing currents and receiving-station transformers, local circuits and translating devices; but that there is no such relationship between the Hunter patents and the Tesla system per se as to subordinate persons making, using or selling the devices essential simply to the principles of the Tesla system, or employing the method involved in the use of such principles alone, to the claims of the Hunter patent.

Electric Railways in Germany.

The Elektrotechnische Zeitschrift published at the beginning of the year full statistics of the electric railways in Germany, brought down to September 1, 1897, showing the rapid growth of electric traction in that country. At the close of 1891 but three towns had electric traction in use, while in 1897 the number had increased to 56, and in addition 7 had definitely decided to adopt electricity for tramway service. Of these 34 it was expected that eight would be in operation before the end of 1897, so that the total number of cities using electric traction at the beginning of the present year is 64. The existing roads have more than 600 miles of track, of which about one-half is double, and, with the exception of 11 miles of underground road in Berlin and less than 25 miles of storage-battery system, this is all overhead trolley.

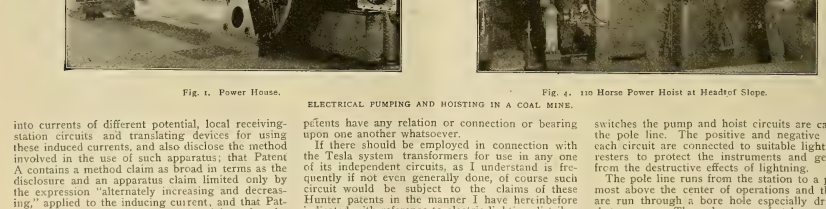

Fig. 1. Power House. Fig. 4. 110 Horse Power Hoist at Headtof Slope.

ELECTRICAL PUMPING AND HOISTING IN A COAL MINE.

Electrical Pumping and Hoisting in a Coal Mine.

Four miles north of Wilkesbarre, Pa., in the mines of the Lehigh Valley Coal company, an interesting electrical installation has been in operation during the last year. The main workings of the mines are under the Susquehanna River Flats, eastward from the shaft toward that river from the Wyoming Hills—the western outcrop of the anthracite coal belt. As the workings were extended the problem of handling the constantly increasing volume of water became daily more difficult and the haulage of coal by mules more expensive. A steam plant on the flats was impracticable on account of their submersion, and after careful investigation the company decided to use electricity for the operation of the mine pump, and an electric cable hoist for the haulage of the coal over an extension of the main gangway.

The power house (Fig. 1) is placed near the head of the main hoisting slant and contains the main hoisting engines, the generator and its driving engine. Steam is supplied from a battery of boilers set in another house about 200 feet away. The dynamo is a General Electric slow-speed, 150-kilowatt, direct-current, six-pole machine, driven by a Ball automatic tandem compound non-condensing engine. The speed of the engine is 200 revolutions per minute, that of the generator 400 revolutions per minute. The generator is compound wound for 500 volts at no load and 550 volts at full load. An iron switchboard is placed against the wall of the engine room, and current passes from the generator to the switchboard through heavily insulated copper cables suspended on porcelain insulators in a conduit under the floor. The conduit is provided with a removable cover, allowing ready access to the cables. The board is provided with two double-pole feeder switches for the pump and hoist circuits in addition to the main double-pole station switch. The pump circuit is protected by fuses, the hoist circuit by an automatic circuit breaker. From the two feeder switches the pump and hoist circuits are carried to the pole line. The positive and negative sides of each circuit are connected to suitable lightning arresters to protect the instruments and generators from the destructive effects of lightning.

The pole line runs from the station to a point almost above the center of operations and the wires are run through a bore hole especially drilled for that purpose. The poles are 30 feet long, and each carries one four-pin crossarm with iron braces, wooden pins and glass insulators.

The positive feeders for the pump and hoist circuits consist of two separate No. 0000 B. & S. wires, and two No. 0000 B. & S. provide a common return. At about 5,000 feet from the power house two bore holes, each 350 feet deep, are driven from the surface of the flats. One is provided with a six-inch iron pipe as a casing for the wires, the other with a 12-inch casing for the pump discharge. The six-inch pipe rises about 18 feet above the surface of the ground; the opening is thus protected against any great rise of water during freshets. A small cable house is supported on this pipe, into which the line wires pass and make connection with the cable in the bore hole. The two positive feeders are connected to two separate cables, and the common return wires to one large negative cable. Each cable is heavily insulated with rubber and jute braid and then leaded and armored with iron wire protected from corrosive and electrolytic action by tarred jute. The cables are supported from the top of the standpipe, as shown in Fig. 2. The method of suspension of the cables is unique. Six cast-iron plates 1½ inches thick and 18 inches square are drilled with three two-inch holes close together near the center of the plate. The six plates are placed one above the other on top of the stand-pipe, and the cables pass through the holes in all of the plates. The six plates are then in three sets, each one in a set forming a clamp tightened by several small bolts. As one cable passes through the bottom clamping set the iron-armored wires are spread out and tightly clamped between the two plates. Another passes through the hole in the first set and is clamped between the plates of the second set, the third armored cable being held between the third set. Each cable is, therefore, supported by its own armor and a separate clamp. These additional lightning arresters protect the cable and line wires in the cable tower.

At the bottom of the hole the cables are connected by single-pole switches to the circuits operating the hoist and pump, 600 feet distant. These underground wires are double rubber-covered and are supported on glass insulators fastened to props along the ribs. A wooden switchboard carrying fuse boxes, main switch and starting rheostat for the pump is erected in the pump chamber.

The motor for this pump (Fig 3) is mounted on a cast-iron bed plate and is geared by a double-reduction gearing to the crank-shaft operating the plungers. The motor is a General Electric shunt-wound machine, with a capacity of 85 horse power continuously at a speed of 600 revolutions per minute. The pump is a duplex, double-acting, pot-valve pump, manufactured by the Jeansville Iron Works, with outside-packed and connecting plungers, 10 inches in diameter by 18 in stroke. The pump capacity at 25 revolutions is 600 gallons per minute, under a head of 360 feet. As with all pumps operated with shunt-wound motors, the speed of the gearing is approximately constant—a great advantage where the pump receives little attention and where the pump capacity is limited. Should the pump happen to run on air, there would be no racing, as in the case of air and steam pumps, and the amount of energy consumed is only that required to overcome the mechanical friction of the rotating parts. The suction pipe drains from a large sump near the pump chamber and the water passes up through the 12-inch bore hole to the surface, where a check valve prevents the water returning during any freshets when the pump is not in operation. A small four-inch by six-inch triplex plunger pump, geared to a five horse power multipolar slow-speed motor, pumps water up the small slope to the large electric pump.

The hoist (Fig. 4) is placed at the head of a small slope extending east from the parting at the foot of

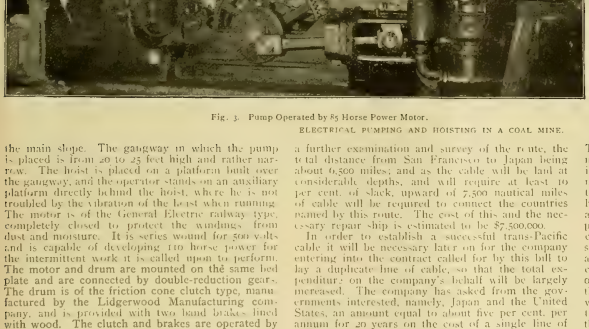

Fig. 3. Pump Operated by 85 Horse Power Motor.

ELECTRICAL PUMPING AND HOISTING IN A COAL MINE.

the main slope. The gangway in which the pump is placed is from 20 to 25 feet high and rather narrow. The hoist is placed on a platform built over the gangway, and the operator stands on an auxiliary platform directly behind the hoist, where he is not troubled by the vibration of the hoist when running. The motor is of the General Electric railway type, completely closed to protect the windings from dust and moisture. It is series wound for 500 volts and is capable of developing 110 horse power for the intermittent work it is called upon to perform. The motor and drum are mounted on the same bed plate and are connected by double-reduction gear. The drum is of the friction cone clutch type, manufactured by the Lidgerwood Manufacturing company, and is provided with two band brakes lined with wood. The clutch and brakes are operated by three levers and quadrants, while the motor is operated by a rheostatic controller to the left of the levers. The controller is provided with a magnetic blow-out. The hoist drum is 48 inches in diameter and 36 inches face and holds about 1,400 feet of one-inch wire rope. Under full load the rope strain on the hoist, at an average speed of 500 feet per minute, is rated at 5,000 pounds. The hoist is operated under the three-rope system; the empty trips are lowered by gravity and overhaul the rope, while the loaded trips are hauled up out of levels situated at intervals along the slop. The lowest level is about 1,200 feet from the hoist. The slope pitches on an average about 5°, with a maximum of 8° at the approach to the knuckle, above which the empty and loaded trips pass on a parting directly under the hoist. The usual load up the slope is four loaded cars per trip at an average speed of 500 feet per minute. Each car weighs about 1½ tons, loaded, and in case of necessity the hoist is capable of hauling six cars per trip.

The installation of this plant was effected by the General Electric company, and since it was started it has operated continuously with satisfactory results.

Pacific Cable Project.

[Special correspondence of the Western Electrician.]

Washington, D. C., March 14—The bill relative to telegraphic communications between the United States, the Hawaiian Islands, Japan and China, which has been before the committee of the whole house, has been amended by the substitution of House bill 6561, and for making the change the committee gives the following reasons:

The committee is strongly impressed with the importance of establishing, at the earliest possible date, suitable cable connections between the United States and the countries named, also incidentally with Europe, via Siberia and Russia.

The Hawaiian Islands, from their geographical position, look upon the United States as their natural commercial ally, and we have a great and growing interest in the commerce of these islands, as well as with Japan and China. Trade between the United States and these countries is undeveloped, and cheap and effective cable communication is essential.

Within the last few years the United States government has been at great expense in the maintaining of warships for the purposes of communication between California and the Hawaiian Islands, owing to the lack of means of cable communication, and so far as Japan, China and other portions of the Asiatic continent are concerned, the present rates charged for messages between the United States and those countries are so high as to be practically prohibitory except where matters of the highest importance are involved.

The proposed cable will start from San Francisco and proceed to the Hawaiian Islands, a distance of 2,097 miles, and thence to Japan and such other islands in the Pacific as shall be determined after a further examination and survey of the route, the total distance from San Francisco to Japan being about 6,500 miles, and as the cable will be laid at considerable depths, and will require at least 10 per cent. of slack, upward of 7,500 nautical miles of cable will be required to connect the countries named by this route. The cost of this and the necessary repair ship is estimated to be $7,500,000.

In order to establish a successful trans-Pacific cable it will be necessary later on for the company entering into the contract called for by this bill to lay a duplicate line of cable, so that the total expenditure on the company's behalf will be largely increased. The company has asked from the governments interested, namely, Japan and the United States, an amount equal to about five per cent. per annum for 20 years on the cost of a single line of cable. This request is based on the theory, well recognized by cable experts, that the life of an ocean cable is ordinarily about 20 years, and that all well-regulated cable companies must accumulate from their net earnings each year an amount sufficient at the end of 20 years to renew its cables. The amount per annum, therefore, which this cable company asked, viz., $200,000 from the government of Japan and $175,000 from this government, was simply sufficient to provide a renewal fund for one line of its proposed cable at the end of 20 years. The committee has felt that the amount asked from this government was somewhat larger than should be granted, and has therefore reduced the amount to $100,000 per year.

The risks of cable ownership are very considerable. The item for repairs and renewals is an uncertain one and at times a very costly one, the committee having satisfactory proof that the repairs to an Atlantic cable have cost as much as $500,000 at a time for a single repair. This is one of the reasons that the committee has rejected against governmental ownership of any trans-Pacific cable.

Under the contract proposed, the Pacific Cable company of New York will transmit free of cost for all time the official messages of the United States government, giving to those messages the right of way. These measures are estimated to amount to about $25,000 per annum at the present time, and this is likely to be increased from year to year.

The rate for commercial messages will be $1.25 per word to Japan and China and 35 cents per word to Honolulu, and press rates to be not more than one-fourth the rate that shall be charged for ordinary private messages.

It is pointed out that former offers have been based upon a yearly subsidy of $250,000 in one case, and in the other $150,000 annually, merely to lay a cable to Honolulu. Another point is the fact that no payment is asked from the United States government until the cable is laid and in efficient working order.

It undertaken this will be the longest cable in the world. It will be laid in an unknown ocean, and soundings show that at one point it will be in 3,185 fathoms of water. If the proposed contract is accepted the cable company will assume all risks of construction and the continual working of the cable. If it should break down the assistance rendered by the government would cease during the interruption.

The Pacific Cable company of New York, with which it is proposed that the contract in question should be made, is organized under the laws of the state of New York, with a capital of $10,000,000. The company proposes to build its cable by sales of its stock, and does not propose to issue bonds,

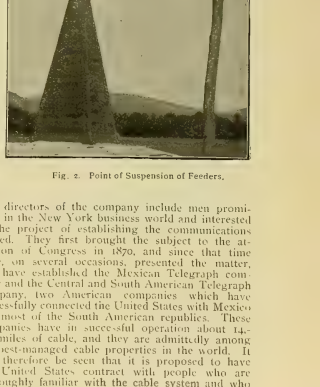

Fig. 2. Point of Suspension of Feeders.

The directors of the company include men prominent in the New York business world and interested in the project of establishing the communications named. They first brought the subject to the attention of Congress in 1870, and since that time have, on several occasions, presented the matter, and have established the Mexican Telegraph company and the Central and South American Telegraph company, two American companies which have success-fully connected the United States with Mexico and most of the South American republics. These companies have in succe-sful operation about 14,000 miles of cable, and they are admittedly among the best-managed cable properties in the world. It will therefore be seen that it is proposed to have the United States contract with people who are thoroughly familiar with the cable system and who have successfully laid and maintained an extensive system of cables.

A. F. T.

Representative Corliss of Michigan on March 12th completed the minority report of the House committee on interstate and foreign commerce against the bill reported by that committee for the establishment of a Pacific cable. The original bill provides for the subsidy of the Pacific Cable company at the rate of $100,000 for 20 years, and provides for the completion of the cable to Honolulu by 1900 and to Japan and China by 1901.

The minority report indorses the proposition for a cable, but objects to the bill of the majority, because it grants an exclusive monopoly and subsidy of $2,000,000, and holds that all franchises should be open to competition; also, that another American corporation is ready to enter into a contract to construct the cable.

It is believed that for the public good the president should be clothed with power to secure the co-operation of Japan for the construction and maintenance of this important public work.

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Thomas Jansen, being duly sworn, deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the foreman of the printing department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the printing of No. 24 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were printed by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified. And further this affiant sayeth not.

THOMAS JANSEN.

Subscribed and sworn to before me this 27th day of July, 1897. Chicago, July 27, 1897. IRA B. JONES, Notary Public.

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Whatever objection may be urged against the plan of the Chicago City Railway company to equip the Wabash avenue and State street lines in the down-town district electrically, it may be said that it is not the intention of the company to consider the third-rail system, even upon the suggestion of such an eminent authority as the Chicago Times-Herald. That journal says that "the third-rail plan is more costly than the overhead trolley, but that is the sole objection which can be urged against it." Our contemporary no doubt had the conduit electric system in mind when it mentioned the "tairdrail plan." At any rate, it is to be hoped that it did not seriously consider the advisability of using the third-rail system on surface lines in crowded city streets.

Municipal ownership forms an important and prominent feature of the local elections at Des Moines and Milwaukee this year, and it also enters the contests at Petoskey, Mich., and other points. The objections urged in Milwaukee and Des Moines are the same that have stood in the way of a municipal plant for several years. Mayor MacVicar seems to be the leading advocate of the scheme in Des Moines, and his personal following will doubtless advance the interests of the project. In Milwaukee the intense feeling that has been displayed against the established corporation has not abated, and it may be said that the success of a proposition to build a city plant in that town will be largely due to the opposition to the men engaged in the local company. In Petoskey the aldermen seem to be wholly at sea.

General Greely made a strong case in pleading for a small appropriation from Congress to be used in laying cables and providing means of electrical communication with the fortifications and other defenses along the coast. In crises such as that now existing in the relations of the United States and Spain it comes as a painful shock to realize that important fortifications in the harbors of Boston, San Francisco and other cities are totally without means of instantaneous communication with the mainland and the other forts. In case the defenses are called into service the need of intelligent and prompt co-operation is obvious; and it seems to be a short-sighted policy to expend millions on elaborate enginery of destruction and withhold the few thousands that would add so greatly to the effectiveness of operating the plant. It is true that the cables can be quickly laid; and it is gratifying to learn that the work is to be undertaken immediately, the cost to be defrayed from the special national defense fund of $50,000,000.

In announcing that Hiram W. Sibley of Rochester has bought from Stephen Vail of New York and presented to Cornell University for the Museum of the Sibley College of Mechanical Engineering the original telegraph receiver on which was taken the first telegraph message over Morse's line from Baltimore to Washington, the Ithaca correspondent of the New York Tribune notes that Cornell is an appropriate repository for this gift, inasmuch as Ezra Cornell put up that first line of telegraph wire, and subsequently made out of the other lines the fortune with which he endowed the university. It might have been added that Hiram Sibley, the father of the gentleman making the gift, made the foundation of his large fortune, too, out of the early extension of the electric telegraph. Hiram Sibley was one of the incorporators of the Western Union company, and was the man who originated, and very largely carried through, the undertaking of the overland telegraph connecting California and the East in 1857-1861. He was prominently identified, too, with the vast project of a line of telegraph to connect the United States with Europe by way of Behring Strait and Siberia, which was abandoned on the successful working of the Atlantic cable. Mr. Sibley was intimately associated with Ezra Cornell and largely endowed the college of Cornell University which bears his name. He was a man of great force of character. He lived to an advanced age, dying in Rochester about 10 years ago.

Electric carriages have attracted the attention of German officials, and the favor with which they are regarded promises well for their development and general adoption in social life in the larger cities. In Berlin several of these carriages are in daily use, and, according to the Elektrotechnische Zeitschrift, they are giving satisfaction. Carriages of this class are built by one of the leading cycle companies of Germany and they are fitted with bicycle wheels and pneumatic tires, which can be inflated to a pressure of 120 pounds, while the bodies are supported on steel tubular frames. The wheels have ball bearings, and steering is effected by means of a lever connected with the front pair of wheels. Each carriage is equipped with a motor suspended from a steel frame lying parallel with the rear axle, the latter passing through the hollow armature shaft, and being driven by differential gearing from a toothed wheel arranged on that shaft. The battery consists of 44 cells in four boxes, the total weight being 800 pounds. It can be charged at a pressure of either 65 or 110 volts, and the connections allow of four different speeds being attained, three by altering the disposition of the battery and one by weakening the motor field. The carriage is provided with a watt-hour meter, which indicates the condition of the battery, and the total weight complete is 1,600 pounds. It is possible to attain a speed of 12 miles an hour, and one charge is sufficient for a distance of 40 miles.

In London very little has been said about the electric carriages or cabs that were put in service several months ago. In Paris there was considerable activity in this industry for awhile, but the French seem to prefer the dirty, foul-smelling oil-engines to the electrically propelled motors. However, it is hardly becoming in Americans, and Chicagoans particularly, to criticize others for neglecting to support this important branch of the business.

No class of inventors in the United States is more interested in the Patent Office than the electrical contingent, and no class of investigators has contributed more to the success of this important branch of the government service than those occupied with the solution of electrical problems. The prominence of the electrical fraternity in Patent Office work and the remarkable expansion of the industry as indicated by the official records are subjects of special consideration in the annual report of the commissioner of patents for the calendar year 1897, which was submitted to Congress on March 14th. Some interesting statistics are presented which may be fittingly reproduced here:

In the electric-light and power industry, as reported in 1880, there were but three establishments in the United States, employing 229 persons and producing an output valued at $458,400. At the close of 1897 there were in the United States 2,124 central stations supplying electricity for light and power and 7,475 isolated plants, a total of 9,599 establishments. The capital invested in these central stations is stated to have been $258,956,256, and the capital invested in the isolated plants, though not stated, was probably not below $200,000,000. A conservative statement of the number of persons employed at that time in this industry would not be under 45,000.

The use of electricity for power purposes has found its most notable development in the electric railway. The first electric street railway in the United States was put in operation little more than 10 years ago. In 1880, of the 2,500 road-miles of street railway in the United States nearly all used animal power. The total mileage of electric railways in the United States up to October of 1897 was 13,765 miles, out of a total mileage of 15,718, of which but 947 miles were horse-car lines. The total capital invested was $846,131,691.

The telephone in 1880 was just beginning to be commercially known. At the close of 1896 there were in the United States 967 telephone exchanges and 832 branch offices, using 536,845 miles of wire and employing 14,425 persons. The total amount stated to be invested in telephone property in 1895 was $77,500,000.

The volume of business transacted by the Patent Office during the year and the proportion of electrical cases considered compares favorably with the reports of former years, especially when the conditions that obtained during the last year are remembered.

It may not be amiss to call attention to another feature of the report which has direct bearing upon the character of the service of this branch of the government. The Patent Office is self-sustaining; more than that, it provides a surplus each year, the amount being increased last year by $252,798. The total balance of the Patent Office in the treasury of the United States on January 1st was $1,971,438. And yet Congress refuses to authorize expenditures that will facilitate the work and provide suitable accommodations for the Patent Office.

International Convention at Laredo, Texas.

[Special correspondence of the Western Electrician.]

Laredo, Texas, March 14.—The joint meeting of the Texas Gas and Electric Light association and of the Texas Street Railway association in this city on March 9th, 10th and 11th was favored with the fine weather customary in this section of the country. The associations, both as organizations and as individuals, met with the hearty reception characteristic of the people of the Rio Grande valley, the citizens of Laredo and of Nuevo Laredo, as well as of the states of the Republic of Mexico, vying with each other in their efforts to make the visitors welcome. The following-named delegates were present:

W. H. Weiss, San Antonio,	R. S. Wakefield, San Antonio,
B. F. Bonner, Houston,	E. Dysterod, Monterey, Mexico,
G. H. Cushman, San Antonio,	B. M. Hammond, San Antonio,
J. E. Johnson, Austin,	H. L. Monroe, Dallas,
T. H. Stewart, Waco,	F. Fries, San Antonio,
Max Levy, Galveston,	W. E. Hamilton, Shreveport, La
Frank E. Scoville, Austin,	W. M. Brooke, Lardeo, Texas,
V. E. Raggio, St. Louis,	A. W. Dutton, St. Louis,
J. R. Cox, Galveston,	J. H. Fitzgerald, Houston,
L. T. Fuller, Calvert,	T. D. Miller, Dallas,
Carl F. Drake, Austin,	E. E. Taylor,
C. F. Yeager, Laredo,	E. L. Wells, Jr.,
W. E. Holmes, Austin,	H. W. Adams,
J. F. Strickland, Waxahachie,	J. D Gibb.

Honorary Members.

Antonio de la Fuente, Monclova, Mexico.
Jose M. Fejada, Monclova, Mexico.
Martinez Negrete, Sr., Guadalajara, Mexico.
Martinez Negrete, Jr., Guadalajara, Mexico.

Prominent Mexican Officials.

L. de la M. Gonzales, Nuevo Laredo, Mexico.
Carlos A. Passament, attorney and president of the Supreme Court of Justice of the state of Tamalipas, Mexico, Victoria, Mexico
Rosemo Valdez, judge of Nuevo Laredo, Mexico.

INTERNATIONAL CONVENTION AT LAREDO, TEXAS

On Wednesday evening the Mexican National Band of the First Regiment of Artillery, the pride of the president of Mexico, arrived from the City of Mexico, and from that time until the visitors dispersed entertained the guests of the occasion with its superb music. This band, consisting of 45 pieces, is the Mexican band that visited the World's Fair at Chicago, and has since been selected to attend the Paris exhibition in 1900. It was sent to Laredo on this occasion, a distance of 865 miles from the City of Mexico, as a special compliment to the associations, by President Diaz. In justice to the associations, it might be said that an immense silver plate, elegantly engraved, will convey the appreciation of the delegates of such a magnanimous act to the beloved president of our sister republic.

The appreciation by Laredo of the honor conferred on her by selecting this city as the meeting place was apparent everywhere and at all times, the decorations and illuminations being particularly admired and the subject of frequent favorable comment by the lighting fraternity.

The exhibits made by many supply men in attendance were tastefully arranged and proved to be an attractive feature. The programme of the meetings as already published was followed closely. At the close of the meeting the delegates were taken on an excursion to Monterey, Mexico, where they were entertained on Saturday and Sunday.

Nearly all of the papers presented during the meeting were subjects of wide and interesting discussion. The lecture and experiments by Mr. Dysterod on X-rays and high-frequency currents were not only delightfully entertaining to the large attendance, but were highly interesting and instructive to the experts of the lighting business, and the delegates pronounced the experiments the best they had ever seen. Another interesting feature was the address by Carl F. Drake of Austin in response to the welcoming address by the mayor of Laredo. It abounded with sentiment and eloquence, and his reference to the friendly relations between the sister republics evoked prolonged applause from the Mexican delegates.

Upon the conclusion of the programme both organizations adjourned sine die, and immediately there was organized the Southwestern Gas, Electric and Street Railway association, to embrace particularly the territory of Texas, the Republic of Mexico, Louisiana, Indian Territory, Oklahoma, Arkansas and New Mexico. The following-named officers were elected for the ensuing year:

President, Carl F. Drake of Austin, Texas.

First vice-president, J. H. Fitzgerald of Houston, Texas (to represent the gas interests).

Second vice-president, E. Dysterod of Monterey, Mexico (to represent the interests of the electric-lighting fraternity).

Third vice-president, W. H. Weiss of San Antonio (to represent the interests of the street-railway people).

Treasurer, F. Fries of San Antonio.

A photograph of a number of the delegates in attendance is herewith reproduced. Fifteen new members were admitted during the meeting. Thirty-six delegates represented gas and electric-lighting interests and the remainder representd street-railway interests.

The addresses to the public were translated and delivered extemporaneously by Louis de Antin, superintendent of public schools of Laredo, Texas, the English addresses being translated into Spanish, and vice versa.

T. D. M.

Commercial Cable Company.

The annual meeting of the Commercial Cable company was held last week. The revenue from the operations of the cables, after deducting all expenses, amounted to $1,209,155, an increase of $70,502 over the previous year. The net revenue from the land lines (Postal Telegraph company) was $645,185. The net revenue from the combined systems was $1,845,341. Out of this have been met the interest on the first-mortgage bonds and debenture stock, dividends of seven per cent. on the stock and bonus of one per cent. on the capital stock—a total of $1,440,000—leaving the balance of net revenue for the year $405,341.12. The further sum of $250,000 will be set aside and invested in high-class securities as an addition to the reserve fund, which will then stand at $2,668,329. There have been added to the land-line system during the year 933 miles of new pole line and [illegible] miles of wire. The directors elected for the ensuing year were John W. Mackay, James Gordon Bennett, Gardiner G. Howland, Colonel William Jay, George G. Ward, Sir William C. Van Horne, E. C. Platt, the Rt. Hon. Lord Strathcona and Mount Royal, Charles R. Hosmer, Thomas Skinner, Clarence H. Mackay, Albert B. Chandler and Dumont Clarke. At the meeting of the directors, which followed, these officers were named: President J. W. Mackay; vice-president and general manager, G. G. Ward; vice-presidents, C. R. Hosmer, A. B. Chandler and C. H. Mackay; treasurer, E. C. Platt; secretary, Albert Beck; assistant secretary, J. O. Stevens.

National Electric Light Association.

Representatives of the electric-lighting and allied interests in and about Chicago are actively engaged in preparations for the forthcoming meeting of the National Electric Light association on June 7th, 8th and 9th. An unusually large attendance is expected, as this is the first time in several years that Chicago has been selected as the place of meeting. Central-station men throughout the West and Northwest who have been unable to attend the eastern meetings are showing considerable interest in this year's gathering, and there will undoubtedly be many new faces at this convention. Another source from which additional attendance will be insured is the street-railway interests of the state. Illinois has a young and energetic state association of street-railway companies, and this organization has named the week in which the National Electric Light association will meet in Chicago for its annual convention, as the railway men realize that there is much in common between the two interests.

Many plans and suggestion were considered by the gentleman invited to confer with President Insull on March 10th upon the arrangements for the entertainment of the visitors during the convention. Formal announcement was made of the action of the association in naming June 7th, 8th and 9th as the time for holding the meeting and the selection of the Auditorium Annex, Chicago, as the headquarters of the association. The banqueting hall which has been secured for the sessions is one of the finest meeting rooms in the country. Space will be furnished for exhibits in the hotel parlors and basement. There will be no general exhibit, the manufacturing and central-station interests agreeing upon that point. President Insull announced that the plant of the Chicago Edison company would be open to inspection at all times during the meeting and that every facility would be afforded members to examine the practical workings of the system. He said that the company would also afford facilities for manufacturers to display their apparatus and specialties in actual operation in the Edison stations. In other words, the Chicago Edison company will keep open house for the association during the convention.

Assurances were received from the street-railway companies and the elevated as well that they would co-operate with the lighting interests in giving the visitors an idea of the advancement that has been made in the electrical development of Chicago since the last meeting in this city. It was also suggested that a visit to the drainage canal would be interesting, especially to the eastern visitors.

It is proposed to hold morning and evening sessions, devoting the afternoons to entertainment and sight seeing. This plan has been tried at the Edison conventions and has proved satisfactory and popular. No definite action was taken on any of the plans suggested, as it was deemed expedient to await the result of President Insull's conference with the eastern representatives. Another meeting of the Chicago committee will be held on Thursday, March 24th, at which time the views of the eastern members will be presented and definite action taken.

An independent telephone exchange is in operation in Pittsfield, Ill., with 100 local subscribers and connections with nearly all the towns of Pike and adjoining counties.

DEVELOPMENT OF THE TELEPHONE FIELD.

Praise for the Western Electrician's Independent Telephone Number.

Additional proof of the favor with which the Western Electrician's Independent Telephone Number was received is presented in the words of praise that are received daily on this subject, some of which are presented herewith. Much interest is also manifested in this journal's new department on the "Development of the Telephone Field," and the hearty co-operation and the encouragement received from the independent manufacturing and operating companies is extremely gratifying.

Elkhart Telephone Company, Elkhart, Ind.: We are glad to see you espouse the good cause in such an earnest manner.

Hudson Telephone Company, Jersey City, N. J.: We are pleased to note the unlimited space you give to the subject of telephones.

Inter-state Telephone Company, Edgemont, S. D.: We are much pleased with your articles on the independent telephone work.

Hammacher, Schlemmer & Co., New York: Your Independent Telephone Number was an excellent one and has been a source of much information to our advertising man.

H. C. Underwood Manufacturing Company, Wabash, Ind.: We are very much pleased with the advertisement in your issue of the Independent Telephone Number, and we consider the issue very attractive.

Taber & Mayer, Boston: The Independent Telephone Number is excellent; it cannot fail to bear rich fruit and aid in keeping the Western Electrician in the front rank of electrical journals, where it belongs.

Warren and Niles Telephone Company, Warren, O.: We think your Independent Telephone Number was very comprehensive and satisfactory, especially to anyone interested in the opposition movement.

Ericsson Telephone Company, New York: We found the Independent Telephone Number very interesting, and we believe it should be productive of good results. We consider that it shows enterprise on your part.

Non-Polarizing Dry Battery Company, New York: We were very much pleased with your issue of the Independent Telephone Number. It looked very neat indeed, and we noted that you had a nice class of advertisers.

Reading Electrical Manufacturing Company, Reading, Pa.: As to your telephone issue we can only say that we are getting inquiries and orders by every mail. We thank you for the care in our "ad" and wish you a prosperous year.

James D. Randall, Memphis, Tenn.: I was delighted with the telephone edition of your paper, published February 26th. The "ads" were artistically set up and illustrated and the reading matter was just what we want. I hope that you will be able to give us more like this number.

Phoenix Electric Telephone Company, New York: The business brought us from the advertisement in your Independent Telephone Number doubled our anticipations, and we must say that never have we given an advertisement to any newspaper bringing us in results equal to those of this number.

Edison Manufacturing Company, New York: We consider the special telephone issue of the Western Electrician a most valuable contribution to telephone literature, and as we understand that it has been sent to every independent telephone exchange in the United States, it will undoubtedly be most carefully preserved for reference.

Mutual Telephone Company, Des Moines, Iowa: We were very much pleased with the Independent Telephone Number, and sincerely trust that you will find the field broad enough to continue, at least to a certain extent, the publication of news touching upon the work already done and being done by the independent telephone companies.

Hatch Storage Battery Company, Boston: Our opinion of the Independent Telephone Number, after a careful perusal of its contents, is that it cannot fail to be of the greatest assistance and benefit both to the telephone companies and the public. We have had several inquiries about our battery since our "ad" has appeared in your valuable paper.

Stromberg-Carlson Telephone Manufacturing Company, Chicago: We sincerely congratulate you upon your marked success in the Independent Telephone Number of February 26th and the space devoted to the "Development of the Telephone Field" in succeeding issues, and believe you should have the most hearty welcome and support of all interested in independent telephony.

James M. Thomas, President of the Independent Telephone Association of the United States of America, Chillicothe, Ohio.: I am greatly pleased with your special telephone number, and desire to congratulate you upon the broad plan which you adopted in editing it. This number is very encouraging to the independent telephone stockholders, and I hope your able journal will receive due return for the interest that you have taken in this movement. I thank you on behalf of the association.

Richland County Telephone Company, Richland Center, Wis.: We wish to thank you for the able support you have extended to the independent movement. In our estimation the Western Electrician should be in the hands of every independent company in the field. We wish you the success due you in your efforts to educate the people in this as well as other electrical subjects.

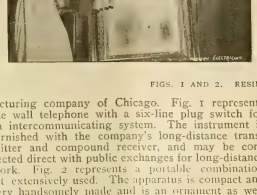
Michigan Pipe Company, Bay City, Mich.: We think that your Independent Telephone Number was very complete in every sense of the word. You gave in your news columns a full account of the independent telephone business and an account of the men who are engaged in it. In your advertising columns you gave excellent announcements of the manufacturers who are engaged in every line of production of materials and instruments used in telephone construction. The Independent Telephone Number could not be excelled.

Pennsylvania Electric Company, Marietta, Pa.: Your issue of February 26th, which was largely devoted to information regarding the independent telephone movement throughout the United States, will do much toward clearing away serious doubts and misgivings in the minds of a great many people as to the legitimacy of the business. The dissemination of this kind of literature is calculated to work more practically to the independent movement than anything that can be done just at this time. We congratulate you on your successful effort, and hope to see more of a similar kind.

Western Telephone Construction Company, Chicago: We wish to congratulate you on your Independent Telephone Number. It was certainly gotten up in a very handsome manner, and covered the telephone situation thoroughly. The Bell company has tried to belittle the importance of the independent companies, but your independent telephone issue fully demonstrates that the antagonists of this gigantic monopoly are sufficiently equipped to give the Bell company a fight that we feel sure they will appreciate as being one hard for them to overcome. It is evident after reading your journal carefully that the people are arrayed against the extortionate charges that have been imposed upon them, and we feel sure that you have helped the cause of reducing the telephone rates materially.

Residence Telephone Systems.

One of the most unique telephone systems especially adapted for residences is that put on the market by the Stromberg-Carlson Telephone Manufacturing company of Chicago. Fig. 1 represents the wall telephone with a six-line plug switch for an intercommunicating system. The instrument is furnished with the company's long-distance transmitter and compound receiver, and may be connected direct with public exchanges for long-distance work. Fig. 2 represents a portable combination set extensively used. The apparatus is compact and very handsomely made and is an ornament as well as an instrument of great convenience.



FIGS. 1 AND 2. RESIDENCE TELEPHONE SYSTEMS.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Representatives of the Bell telephone companies from Iowa, Nebraska, Kansas and Missouri met recently at Omaha and discussed a schedule of rates on interstate business.

There is talk of an independent telephone company connecting with Delta, Ia.

The Woodbine Telephone company contemplates extending its lines to Harlan, Ia., with a line from Portsmouth to Panama.

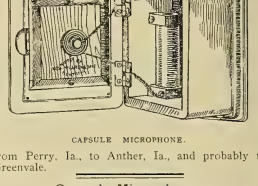
The scheme of the American Telephone and Telegraph company to get into La Crosse, Wis., without a franchise, by connecting with the Wisconsin Telephone company's system at the city limits has roused the ire of some of the aldermen and they declare that if the scheme is put through they will at once take steps to revoke the franchise of the Wisconsin Telephone company. They declare that the company said it was independent of the Wisconsin company, and this action, it is claimed, shows that the two companies are allied.

The Interstate Telephone company has been incorporated at La Crosse, Wis., with $100,000 capital stock. The incorporators are P. S. Elwell, George W. Bunge and Andrew Lees, three young attorneys of La Crosse. The company will be allied with the independent companies, and it is understood that the Winona Telephone company of Winona, Minn., is interested.

The Wisconsin Telephone company is arranging to extend a line from Chippewa Falls, Wis., to Stevens Point.

A long-distance telephone company will extend its wires to Morgan, Minn., this spring.

The Perry Telephone company will extend a line

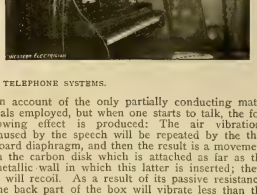


CAPSULE MICROPHONE.

from Perry, Ia., to Anther, Ia., and probably to Greenvale.

Capsule Microphone.

This transmitter has been fully tested in competition with other microphones and has given satisfactory results. The microphone is composed of two carbon disks inserted in the two halves of a small metallic box, each being insulated from the metal by means of a round of cardboard. The box is filled up to five-sixths of its height with granules of sifted carbon. One of the disks is fastened to the vibrating board, and a hole on each carbon serves to attach the wires for carrying the current; finally, the front of the disks which hold the carbon granules are slightly fluted to ensure contact with the carbon grains. When the receiver is removed from its hook, the current passes in small quantity.



on account of the only partially conducting materials employed, but when one starts to talk, the following effect is produced: The air vibrations caused by the speech will be repeated by the thin board diaphragm, and then the result is a movement in the carbon disk which is attached as far as the metallic wall in which this latter is inserted; there it will recoil. As a result of its passive resistance, the back part of the box will vibrate less than the front part; it will then cause a microscopic flattening of the microphone, a compression of the powder, and then an increase in the contact surfaces. The current will pass in larger quantity; it will go out on the line and attract the diaphragm of the receiver at the other end, so that the speech will be clearer, the vibration sharper and the compression more energetic. The simplicity, the small dimensions of this microphone, the number of its contacts and its power of transmission all combine to make it very popular, not only for private lines, but for long-distance service, and its good qualities have already been recognized. Two cells of battery must be used in every instance. An induction coil wound to 150 ohms gives the best results. Ness, McLaren & Bate manufacture this device. Their headquarters are at Montreal, Canada.

Mutual Telephone Company, Des Moines, Iowa.

During the recent meeting of independent telephone men at Des Moines, Ia., considerable interest was manifested in the exchange of the Mutual Telephone company of that city. The company organized about one year ago, and the construction of the plant was started March 1, 1897. Enough of the work was completed in time to open the exchange October 1st, with a list of 700 subscribers. This list now numbers nearly 1,200 subscribers. In the construction of the plant 12,740 feet of underground conduit having been built, 2,500 poles erected, 900 miles of wire strung and 22,000 feet of cable placed, all of which has been done under the direction and supervision of C. W. Bartlett, the manager of the company, whose portrait is herewith presented. An interior view of the Des Moines exchange is also shown, giving an idea of the operating room. The switchboard was built by the Connecticut Telephone company of Meriden, Conn.

As indicated by its name, the company is a mutual concern, and was organized on a somewhat different plan from most of the independent telephone corporations of the country. The company is authorized to construct toll lines from its principal exchange in Des Moines to such other towns and cities as may be deemed advisable. The company is also empowered to construct and maintain conduits under the streets and alleys of the city of Des Moines for the purpose of carrying telephone, telegraph, electric-light and other electrical wires.

The capital stock of the corporation is fixed at $50,000, divided into 2,000 shares of $25 each.

According to the articles of incorporation each shareholder of the corporation shall be entitled to the use of one complete connection on the general exchange switchboard, one telephone instrument and line connection from telephone instrument to the general exchange for each share of stock owned by the shareholder, the line connection to be within one mile of the general exchange. Shareholders desiring their line connections to extend outside of the one-mile limit shall pay an additional sum to cover actual cost of line construction outside of the mile limit, and any shareholder desiring to have his telephone moved from one part of the city to another may do so by paying for the actual cost of making the removal, including the cost of new line, if necessary, and under such regulations as the board of directors may provide.

The board of directors shall determine the amount that each of the shareholders shall pay to the corporation each quarter for service, which shall be the actual cost of maintaining, operating and keeping in repair the exchange, including all telephones, all line service and other necessary expenses. The amount shall be in all cases equal for business telephones and for residence telephones within a two-mile limit from the general exchange, but the charge shall not exceed $6 per quarter for business telephones and $4.50 per quarter for residence telephones within the two mile limit. The extra charge for telephones outside of the two-mile limit shall not exceed 75 cents per quarter per mile from the two-mile limit for each telephone in addition to the amounts fixed for telephones inside of the two mile limit.

The board of directors is also authorized to purchase additional telephones and to rent them and furnish exchange service to others than shareholders at such prices as shall from time to time be agreed upon.

Provision is made for turning the plant over to the city as follows: "This association may, in any charter to be granted by the city of Des Moines, agree that at the expiration of five years from the time the corporation commences business it will turn over to the city of Des Moines the entire plant, including central exchange, telephones, underground and overhead lines, at an appraised value, to be arrived at as follows: The city choosing one appraiser,

C. W. BARTLETT.

the company choosing one, and the two thus chosen to choose the third one, or on such other terms and conditions as may be agreed upon between the said city of Des Moines and this association."

The present officers of the company are J. W. Hill, president; D. F. Witter, vice-president; H. E. Teachout, secretary; A. C. Miller, treasurer; C. W. Bartlett, manager. The board of directors is composed of J. W. Hill, D. F. Witter, H. E. Teachout, A. C. Miller, Crom Bowen, J. D. Whisenand, G. B. Ellyson, M. McFarlin and Charles Mackenzie, and the executive committee, J. W. Hill, D. F. Witter, H. E. Teachout, J. D. Whisenand and M. McFarlin.

Mr. Bartlett, the superintendent of the company, is one of the most active anti-Bell men in the Northwest. He is an experienced business man and his

MUTUAL TELEPHONE COMPANY, DES MOINES, IOWA—SWITCHBOARD.

management of the Mutual company has produced marked effect upon the telephone interests throughout Iowa. Mr. Bartlett has taken a prominent part in the independent movement and is an active member of the Iowa association.

Commercial Telephony.

From the Telegraph Age.

In the present existing state of rivalry between the telephone and the telegraph, the telephone is steadily increasing in popularity, while the telegraph companies are barely holding their own and earn less and less profit each year.

It will be only a matter of time, a few years at most, before the telephone companies will control much of the commercial business of small towns which is now transacted through the medium of the telegraph.

Iowa Telephone Association.

The Iowa Telephone association, representing the independent telephone interests of the state, held its annual convention at Des Moines on March 8th. The association selected Des Moines as its permanent meeting place. The following-named companies were represented:

Spirit Lake Telephone company, by W. W. Pritchard.
Jefferson Telephone company, by C. G. Cockerell.
Perry Telephone company, by G. N. Bandy.
Boone Telephone company, by C. E. Wells and C. C. Deering.
Madrid Telephone company, by J. P. A. Anderson.
Marshall Telephone company, by W. G Bowe.
Oskaloosa Telephone company, by S. T. Slade.
Washington Telephone company, by C. D. Robinson.
Cedar Rapids Telephone company, by W. R. Durio.
Clearfield and Mt. Ayr Telephone company, by D. N. Smith.
Conway Telephone company, by G. A. Haynie.
Jefferson County Telephone company, by W. R. Hine
Waterloo and Cedar Falls Telephone company, by Dr. C. F. Bennett.
Knoxville Telephone company, by Mr. Bellamy.
Mutual Telephone company, by J. W. Hill and H. E. Teachout.
E. H. Martin Telephone company, by E. H. Martin.

An excellent programme had been prepared, including papers and practical talks by members. Following is a list of the papers and the gentlemen who presented them:

"Toll Rates," by M. Pritchard, Spirit Lake.
"Territorial Construction of Toll Lines and How to Build Them," by C. F. Bennett, Waterloo.
"Modern Switchboard and Appliances," by H. E. Teachout and C. W. Bartlett, Des Moines.
"Toll Line Accounts," by E. H. Martin, Webster City.
"Toll Line Signs," by G. N. Bandy, Perry.
"Exchange and Toll Rates," by C. G. Cockerell, Jefferson.
"Construction of Toll Lines and Material to Be Used," by C. E. Wells, Boone.
"Cables, Protection and Insulation," by C. W. Bartlett, Des Moines.
"Franchises and Use of Public Highways," by Major Mackenzie.

The membership of the association has been increased by one-third during the last year. There are now 34 operating companies in the association, and accessions to this number are expected. Communications were read from a number of companies expressing regret that they were not able to have representatives present, and saying they desired to join the association. One of these communications was from J. C. Hubinger, the Keokuk capitalist, who is interested in several lines.

C. E. Wells of Boone was elected president. He read a paper during the meeting upon the toll-line business, and this really formed the principal subject of consideration. Statistics were presented to show the marvelous growth of the independent toll lines in the state. Three years ago there was scarcely a mile of independent toll line in Iowa. Now there are 2,200 miles, and 1,000 miles of new toll lines are projected. This summer metallic circuits are projected which will connect with the important towns in the vicinity of Des Moines, with which there are now no independent connections.

The matter of covering territory with toll lines not already reached was discussed, and an agreement reached that each independent company should build into territory adjacent to its exchange, with the object of covering the state as thoroughly as possible, without paralleling lines and without unnecessary competition and expense.

It is understood that construction is to be begun at once of a metallic circuit line between Boone and Marshalltown, which will connect with Ames, Nevada, State Center and other towns. These will all be connected with Des Moines.

Arrangements have also been made for a metallic line from Des Moines to St. Joseph, Mo., connecting with the county seats. Through St. Joseph, Des Moines will be connected with St. Louis.

The present connection with Boone, Fort Dodge, Webster City, Perry, Jefferson and other points north and west will be made metallic the coming season. At present there are toll line connections with those places by grounded line circuits. The metallic circuit will be used for through business, and the grounded line for local business.

A line will also be built from Des Moines to Oskaloosa this summer. Cedar Rapids, Marion and Marshalltown will be connected this season.

A line will be built from Council Bluffs to Red Oak and other points in the southwest. A line will be built from Atlantic to connect with Creston.

Twenty-seven new exchanges are now in process of construction, or will be constructed this spring by members of the association and other independent companies. In the near future the association hopes to extend its toll-line service to connect with every town of importance in the state.

Steps will be taken to secure a better class of toll lines and uniformity in the construction of them. This will admit of a more satisfactory exchange of through business.

The association decided on a uniform sign for the independent companies. It is a blue and white enamel sign, 17 by 17 inches, made in the form of a Maltese cross, with the words upon it: "Local and Long-distance Telephone."

The association decided upon the Hawkeye Telephone Construction company, of which C. W. Bartlett of Des Moines is superintendent, as the concern which should be patronized by its members, the company agreeing to carry a full stock of supplies.

Canadian Bell Telephone Company.

The annual meeting of the Canadian Bell Telephone company was held in Montreal on February 23d. There were present at the meeting C. F. Sise, president; R. Mackay, F. X. St. Charles, G. A. Greene, P. R. Gault, Hugh Paton, C. R. Hosimer, R. Archer, R. W. Shepherd, Charles Cassils, T. D. Hood, F. G. Payne, R. P. McLea, C. A. Briggs, C. F. Paul, James Wilson, Herbert Wallace, George Sumner, H. A. Budden, M. S. Foley, E. Rawlings, John Crawford, J. A. Grenier, George H. Holt, D. Ross Ross, Charles Garth, F. B. McNamee, James Shearer, James Williamson.

The annual report was submitted. The net revenue for 1897 was $297,751.57, and after dividends have been deducted the company will carry forward $82,364.17 to its 1898 account. Nine hundred and eighty-three subscribers have been added during the year, the total number of sets of instruments now earning rental being 30,445. The company now owns and operates 349 exchanges and 261 agencies. Thirty-five miles of pole and 703 miles of wire have been added to the long-distance system in 1897; of these five pole-miles and 200 wire-miles are in the Ontario department, and 30 pole-miles and 494 wire-miles are in the eastern department. The long-distance lines now owned and operated by the company comprise 16,567 miles of wire on 6,095 miles of poles. Under the authority of the shareholders $66,500 bonds have been sold during the year, the premium thereon being 10 per cent. Continuing the policy adopted in former years, the directors have charged to contingent fund $150,000, that amount having been expended during the year on construction rendered necessary by the introduction of trolley and other wires, but which has not increased the earning power of the plant.

The following-named directors were elected: C. F. Sise, Robert Mackay, John E. Hudson, Robert Archer, William R. Driver, Hugh Paton, Charles Cassils, Thomas Sherwin.

Telephone Service at Washington.

A bill has been introduced in Congress for the erection and operation of a postal telephone system in Washington, to be under the control of the postmaster-general. The sum of $100,000 is asked for this purpose, which would be the means of connecting all the public buildings and government offices of the city.

The matter of charges for telephone service in the District has been brought to the attention of the Senate by means of a bill introduced by Senator Pettigrew, which provides that it shall be unlawful for any person or any telephone company doing business in the District to receive for the use of one telephone any more than the following rates: In hotels or other places of business, $50, and $36 for each telephone used in residences, within a radius of one mile from the telephone exchange, and for each additional mile a further charge to business places of $4 and for residences of $3; these prices to cover a service as efficient as any now rendered in the District. The bill further provides that any subscriber is entitled to telephone service for his servants and the members of his immediate family, but no other persons shall have the right to use without further charge any other telephone equipment, with the consent of the owner of same. Anyone charging in excess of these rates, or a refusal of any of these privileges, will be fined $25 upon conviction. If within 30 days after the passage of the act any company now operating in the District shall not have changed its rates to conform with the foregoing, then the commissioners may permit any other company or companies to install a service, upon bond being filed to the amount of $100,000, and the assurance that it will maintain its service for a period of not less than five years.

Independent Telephone Movement in Indiana.

In the course of S. P. Sheerin's address before the city officials of Indianapolis recently in which he advocated granting an independent telephone company a franchise, he presented petitions signed by residents of the following named towns who desired to have the new company established, in order that they could have telephonic communication over independent lines with Indianapolis:

Franklin,	Huntington,
Elkhart,	Frankfort,
Elwood,	Bluffton,
Connersville,	Warsaw,
Cicero,	Middletown,
Bloomington	Worthington,
Rockville,	Pendleton
Danville,	Ft. Wayne,
Rushville	Veedersburg,
Noblesville	Dunkirk
Maplewood,	Greenfield,
Lizton,	Wabash,
Center Valley	Madison,
Pittsboro	Winamac,
Delphi,	Lagrange,
Hazelwood,	Rochester,
Shelbyville,	Hartford City,
Lebanon	Lafayette,
Logansport,	Cumberland
Greencastle	[illegible]
Cloverdale,	[illegible],
Roachdale,	Knightstown,
Bainbridge,	Winchester,
Plymouth,	Crawfordsville,
Columbus,	Annapolis,

It was claimed that these towns, according to the United States census of 1890, represented more than 900,000 persons.

The Telephone Situation.

By J. J. Nate.

Part II.

Toll Lines.

From the work thus far accomplished by the independent telephone companies in the way of territorial and interstate toll-line construction, it is clear that as an investment it is equal to, and, in some instances, better than, exchange construction.

At the present writing many thousands of miles of wire is in use by the independent companies over which tolls are being daily collected. A complete list of this mileage is not at hand, but the Western Electric and Union Telephone companies of Iowa are successfully operating to-day over a system, comprising fully 3,000 miles of line, the greater part of which they own, and their patrons are receiving good service throughout a territory embracing Iowa, Minnesota, South Dakota, Wisconsin and Nebraska. The same companies have recently completed an organization for the extension of their system to Kansas City, St. Louis and other principal points south and west, and have also secured a franchise for the construction and maintenance of toll lines and suitable terminal facilities in Minneapolis and St. Paul, and during the coming season will thoroughly reconstruct their lines so that the best of service can be furnished over the entire system from one end to the other, which, when completed, will pretty thoroughly take in the Mississippi Valley country.

In Pennsylvania and West Virginia another combination system of toll lines has been completed, and is in full operation to-day, comprising a total of over 1,600 miles of line, while in the states adjoining local companies are gradually reaching out with toll-line connections, and in a very short time a complete system of independent toll-line service for the entire southeastern portion of the country can be looked for.

Pennsylvania, Ohio, Indiana, Michigan, Wisconsin and Minnesota are all states in which the independent exchanges own and operate at the present time from 2,000 to 4,000 miles of toll lines. In the eastern states intervening points between independent exchanges are rapidly being covered. In the northern states the work is now going forward, and with the beginning of spring we have reason to believe that Duluth, Superior, Ashland and other Lake Superior points will all be in communication with the Mississippi Valley system. On the Pacific Coast we find a considerable mileage of independent toll lines, and in the South a greater percentage than one would imagine.

A telephone line equipped for toll service should be of the very best construction, the cost per mile varying somewhat according to the distance over which it is necessary to give good service and the nature of the country through which the line must pass. Even short lines between large towns should be of construction that can be made available for long-distance service. A line constructed of one No. 10 iron wire conductor (and nothing smaller should be used under any circumstances) would cost under ordinary conditions from $50 to $60 per mile, about as follows:

Thirty-five (30-foot) poles, five-inch tops......	$35.00
Two hundred and forty pounds of No. 10 B. B. galvanized wire at 3 cents per lb......	7.20
Brackets, glass and spikes..................	1.00
Distributing and setting poles...............	17.50
Stringing wire	2.00
Total	$62.70

The same line, if equipped with two No. 10 wires and six-foot cross-arms, would cost $75 per mile; if constructed of No. 12 hard-drawn copper, one wire, the line would cost $70 a mile, and with two wires, $100 per mile. These figures cover A-1 construction. As a matter of fact, many of the companies which have so far constructed territorial lines find that with the use of 25-foot poles at 25 to a mile, and using a No. 10 iron wire, it is possible under favorable conditions to construct a line at a cost of $40 per mile.

Many independent companies which were unable to appreciate the rapid growth of toll-line service constructed miles of toll lines using No. 12 iron wire. Actual tests show that good service could be given over such a line up to 100 miles, including from 15 to 20 stations, and these are the people who will find some reconstruction necessary in order to give service which will compete successfully with the Bell company's long-distance work. Loss of toll-line business has presented to the Bell company a problem which has received careful consideration and resulted in a decision to spend all the money necessary for the equipment and building of superior toll-lines, covering in many instances the identical territory over which they have furnished an inferior service for so many years. This move must not be lost sight of by the independent companies if they wish to retain the prestige gained through a generous support of the public at large, and, strange to say, an improved service.

There seems to be absolutely no question but that if independent companies of this country will furnish a satisfactory service, the support of the people can be relied upon. From statistics based upon actual work in toll-line service, it has been ascertained that 85 per cent. of the businesss transacted by 'phone is confined to one county and those immediately adjoining, while 10 per cent. is found to be within a radius of 200 miles; the other five per cent. may be considered extremely long-distance service between large cities, and which the independent companies have not thus far attempted to handle, nor is it at all necessary that they should. It needs but little argument on the part of an independent toll-line company to convince its customers that it covers fully all the territory necessary and is able to furnish an all-sufficient service at greatly reduced rates. In larger cities a demand exists for service over 1,000 miles of wire or more, but this demand is confined principally to large concerns with headquarters in great business centers, which can well afford to pay the high rates of toll asked for this class of service. How often does the doctor, lawyer or country merchant in smaller cities and towns find it necessary to call for points a thousand miles away? A telegraph message lets him out every time at an expense of 25 to 50 cents; anything over $1 for telephonic communication is not paid out by the people at large, except in very rare instances, such as in large money transactions, a sudden death or from an agent of a large company to headquarters. I think that we may safely say that the American Telephone and Telegraph company will successfully handle this business, and that those who wish to make use of that service will find it no hardship to hunt up the company's toll station in such an event. For years and years customers in smaller places found it necessary to go in person to the Western Union Telegraph company's office in order to send a telegraph message, and certainly an occasional visit to a long-distance station, supposing a man wishes to talk seven or eight hundred miles once or twice a year, is no hardship, and does not indicate the necessity of a Bell telephone in his place of business. A public-spirited man who is desirous of retaining at home money earned in his own community will support local enterprises, providing he is given satisfactory service, and unless he be a man of very large interests he will find as a matter of fact that his business is confined within a distance of 200 miles or such a matter, and is not only satisfied but anxious to patronize home industries, just as long as he gets value received. Therefore, long-distance telephony does not enter into the success of local independent enterprises, beyond an ability to satisfactorily deal with the problem, and the more thought given to this matter by those who are in doubt and the closer the investigation, the more certain will this fact become apparent.

One vital point in regard to toll-line construction has up to the present time been very largely lost sight of by the independent companies, and in consequence an evil is growing up which in the immediate future implies unnecessary expense and loss of business. I refer to the indifferent means employed to establish connections over the lines of the different local companies at interconnecting points. The apparatus at one exchange may be utterly unsuited for efficient service over the lines or the system of a neighboring exchange. This condition is largely due to the purchase of cheap and inferior material, which perhaps fairly answers the purposes of a small exchange, but is in no wise adequate to the work of toll-line service and the employment of men who do not understand these matters. There is a way out of these difficulties and it should be followed up at once.

Investment.

The telephone business requires attention and practical and expert knowledge in order to make it a success. Like any other business, its affairs may be properly managed by men of good business ability, but its operative work and the many details incident thereto must be superintended and cared for by men who are conversant with the business, or needless expense will run the cost of maintenance so high that "earnings surplus" will be very nearly if not entirely wiped out. Profits are large in the business, barring accidents, which 99 times out of 100 are the result of carelessness. Promoters should not lose sight of the risk they are taking when their construction work is indifferently performed or their employes careless. One verdict for $5,000, the consequence of an accidental death, due to an open post-hole or defective cross-arm or bungling work in the handling of large poles, will most effectually wipe out net profits for a long time. A man is most certainly "penny wise and pound foolish" who entrusts construction work to men who are inexperienced and necessarily incompetent.

Toll-line earnings vary according to rates. The independent companies of the country as a rule have practically cut the Bell rates in half, and even then are doing very nicely indeed and are well satisfied. I have been told of one line in particular, costing about $4,000, that is and has been for over a year earning $10 per day net. Needless to say, this is an unusual condition. Another company of which I have personal knowledge has invested to date about $60,000 and is now collecting for tolls over $1,500 per month. It has found about 20 per cent. net thus far on the investment. The business is so good that men known and recognized as men of ability and prominence are devoting their entire time and attention to telephone interests.

Novel High-tension Series Enclosed Arc System.

By J. H. Hallberg, E. E.

Many articles have appeared in the pages of this journal describing the enclosed arc lamps and calling attention to their many advantages, but the writer has not seen any particular attention called to the high-tension series enclosed arc lamps

I will first take up a few questions as to the requirements of the enclosed arc lamp for high-tension series street lighting and commercial circuits. The insulation should consist of mica, lava and porcelain; fiber should never be used in arc lamps, except for switch handles. When testing insulation it is best not to depend on the ringing of a magneto bell. Take one wire from the magneto in operation and connect to the ground or to the frame of dynamo or cover of lamp. Then the other wire should be attached to a small handle and taken in one hand. With the other hand touch some connection or bare wire in sure contact with circuit. To be perfectly sure the hands should be wet. It is understood that the operator must be insulated from the ground. I have found this method to be the surest where no special testing apparatus is at hand, as you will surely feel the current from the magneto if there is a leak. Never depend on ordinary insulation in high-tension series lighting, as the extremely high pressure of the "kicks" caused by flashing of the dynamo or the breaking of a wire will break through any ordinary insulation and consequently ground lamps and apparatus. The lamps should be provided with a standard hanger and so designed that they will fit in the majority or hoods with hanger-boards now in use. The lamp should be provided with a cover that can be easily removed for inspection. The lamp should be snow, rain and as nearly dustproof as possible and at the same time ventilated. All parts should be easily interchangeable with the use of no other tool than a pair of pliers and a screwdriver. My experience has been that it is better to use binding-posts and connectors than solder, for various reasons, the main one being that a coil can be changed without the troublesome use of a soldering iron. The cut-out should be positive in its action and have a sure adjustment, and its contact points should be easily interchangeable. It is preferable that the clutch should work directly on the carbon, as the wear of the clutch is thus reduced on account of the softness of the carbon. The lamp should be equipped with some device to prevent the slipping of the carbons. In a differential lamp the slipping could only happen during its burning, as the carbons are together during the day or when the lamp is not working. In a shunt-wound lamp the device should always be in action, as the carbons in a shunt lamp are always apart except at the moment that the arc is struck. This device may seem unnecessary, but experience has proven that the best of clutches will slip in stormy weather, especially on lamps placed on tall poles, or if they are suspended from poles which also carry one or more trolley wires.

The inner globe should be easily interchangeable, as when trimming a number of lamps it is demonstrated that it is best to exchange the dirty inner globes for clean ones, and bring the dirty globes and what is left of the upper carbon back to the station, where the former are cleaned and the carbons are cut to the right sizes for negative or lower carbons for the next trimming. The lamp could be so designed that it would maintain the same voltage at the terminals and arc, whether the amperes be four or seven, varying, or any constant between these two numbers. A lamp designed for four amperes should operate on any amperage between four and seven. The arc in the lamp should consume the entire voltage as measured at hangers except one volt. This one volt is all that is necessary to hold the cut-out open. When the lamp is cut out automatically not over four volts should be expended when lamp coils are hot. The shunt coil and cut-out should not consume over one-tenth ampere when the lamp is hot. If possible, the lamp should be so designed that no dash pot or spring would be required in its mechanism. This is very important; most station managers have probably experienced more or less trouble from dirty dash pots, feed and cut-out springs. In many cases these lose their tension, which would either keep the lamp out entirely, or destroy all adjustment, allowing the lamps to burn 30 to 70 volts, instead of 45 to 50. The writer knows of some cut outs that would not shunt the lamp until the arc reached about 140 volts. This, of course, would burn the shunt coils in the lamp, as they were only designed to stand a maximum of 70 volts. I believe all will agree that a spring and a dash pot are the most frequent causes of trouble on a high tension street lamp, which is subjected to internal heat and to dust and dampness. The lamp should be of light weight, say 25 pounds, complete with hood, hanger board and globe, so as to allow the use of lighter construction and suspensions; a light lamp will also make the old balancing weight unnecessary, and on shipments of lamps the freight is about one-half of that paid for old-type long and heavy lamp. The lamp should be adapted for either inside or outside service without change; at the same time they should be so designed that if necessary the plain cover can be substituted for a fancy one without any changes on the lamp. The lamp should be as short as possible, say, about 34 inches from top of hanger to bottom of globe, so as to allow the lamp to be used in low-studded buildings, basements and hallways. If it should be necessary to have a long lamp in order to suit some particular customer, it can be done by simply putting on a longer cover without changing the mechanism or the globes. The lamp should regulate so that its voltage would not vary over five volts at any time from normal. The lamp that is designed and built so as to come up to the specifications should certainly meet with the approval of most station managers and electrical engineers. Since the invention and perfection of the enclosed arc lamp it is possible to build a lamp of the type mentioned, and the writer, after personally handling nearly 100 of them for street-lighting purposes during the last 10 months, has come to the conclusion that it is the most convenient street lamp and will surely occupy a prominent position among the enclosed arc lamps, as it possesses higher efficiency than any other type of enclosed arc lamp as yet advertised in the country. The light from the high-tension enclosed series arc lamp possesses all the advantages that are so noticeable in the low-tension direct-current enclosed lamp, which are a perfectly steady light, perfect diffusion and distribution, the tint of which can be governed by the use of different combinations of globes. It burns from 100 to 150 hours with one 12 by one-half inch solid (imported) carbon. This not only saves labor in trimming and attention, but the lamp mechanism and clutch does not wear, as the lamp feeds only a few times every 12 hours. It must also be remembered that the clutch works on the soft carbon, which prevents it from wearing, and as there are no carbon rods, the repairs on an enclosed arc lamp are only about 10 per cent. of that for the open-arc system. If we now get such a lamp it would be perfectly proper to ask the following question, if you do not already realize the economy of a plant equipped with this type of lamp for street lighting: How do these lamps compare with the open-arc system in regard to amperes, voltage and candle power? The old type open-arc lamp requires 10 amperes and 45 to 50 volts (equal to 500 watts) to produce what is known as 2,000 nominal candle power. The new enclosed arc lamp with clear globes requires seven amperes and about 71½ volts (equal to 500 watts) to produce 2,000 nominal candle power. From the figures given it can be seen that the wattage remains the same for both types of lamps: consequently the coal bill is not increased when the enclosed series lamps are used. The enclosed arc lamps require about 30 per cent. higher voltage, but the amperage may be reduced accordingly. I consider this a great advantage, especially if your circuits are very long, as the line loss would be cut down considerably. If you desire a 1,200 candle power system your wattage consumption would be about 300 to 325 (equal to four amperes and 80 volts, or five amperes and from 60 to 70 volts). I mentioned in the early part of the article that a shunt-wound high-tension enclosed series arc lamp could be so designed that it would operate with the same arc voltage, even though the amperes vary about 40 per cent. The advantage of this will undoubtedly be seen. To-day it will be found that almost any manufacturer of arc dynamos will furnish regulators and controllers, by the adjustment of which you may change the amperage from, say, 4½ to 6½ amperes, and the dynamos will hold their amperes very steadly at any point. This enables you to get a perfectly controllable arc circuit, which may be varied at will from the station.

On dark nights you may run your dynamo at seven amperes. The next night may be moonlight, then you can cut your dynamo down to say five or six amperes; then, during winter, when snow is on the ground, you will not over, say, 5½ amperes during the darkest nights. On moonlight nights, with snow on the ground, you could probably go as low as 4½ amperes on your circuit and still you would light your streets equally as well as you would on a very dark night with seven amperes. This feature of this system will save a station or a town a good many dollars. Figures show the following:

200 lamps at 70 volts each = 14,000 volts and seven amperes = 98,000 watts.

200 lamps at 70 volts each = 14,000 volts and 4½ amperes = 63,000 watts.

This shows a saving of 35,000 watts per hour. If your plant can produce one electrical horse power per hour with four pounds of coal, you would save during an 11 hour run on 4½ amperes instead of seven amperes about one ton of coal, equal to, say, about $2. By applying this system I am sure a great many managers who now shut down at 12 p. m. could persuade the town which they light to pay a little more and run on a very low amperage the rest of the night, and then it might be profitable to run an all night incandescent circuit. I am sure lighting plants in small towns could get many new customers on their incandescent circuit if they could afford to run until daylight instead of shutting down at 12 p. m. These are only a few examples showing the many advantages that can be gained through the use of this system. There are many stations which have four to seven ampere dynamos that are not in use. For, as the town grows, the requirement changes, a larger light is wanted, and a 10 ampere arc system has to be put in. Now clean and fix up your old four to seven-ampere dynamos, write for information to arc lamp manufacturers who make a high-tension series enclosed arc lamp. Be sure that the manufacturers guarantee the lamp to burn on a varying amperage of say about three, without change in the voltage at hangers, as your old-type dynamo may not regulate as well as the later designed and improved lamps. So you see, if the town board should vote to put in 15 or 20 new 2,000 candle power arc lamps, and your present 10-ampere dynamos are loaded, you can, if you have an old 6½-ampere dynamo, by simply buying this type of lamp and putting up new circuit, furnish this town with this lamp and save the cost of a new dynamo. The foregoing explanations and suggestions might alone show station managers how they would profit by the use of an arc lamp of this type, but I will now call your attention to the most important fact, and that is, that this lamp operates for 125 hours without any attention or trimming. At each trimming there is only used one 12 by one-half-inch ("solid imported") carbon. The cost of this quality of carbon is between $27 and $30 per thousand; consequently a lamp of this kind, if operated 10 hours every night in the year, will consume 30 of these carbons per year, equal at highest carbon price to 90 cents. If your carbons for the old type open-arc lamp cost you $15 per thousand pair, delivered (this is certainly the lowest cost figure), then a lamp of that type which consumes one pair of carbons each night of 10 hours requires 365 pairs for one year, equal to $5.47½, and making a saving of $4.57½ each year per lamp in carbons alone.

As the enclosed arc only needs trimming once every 10 or 15 days, one or more trimmers may be dispensed with. The enclosed arc having an inner globe, a deduction of about $1 per year for each lamp might be made from the above figures to allow for the additional chances of breakage.

Badt Hermetic Cell.

The accompanying cuts illustrate the Badt hermetic cell which has only recently been placed upon the market, but which has been the object of much interest among primary-battery men who have been acquainted with the experiments conducted by Lieutenant F. B. Badt in perfecting it. It is an

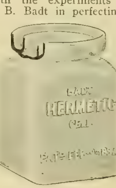


Fig. 1.

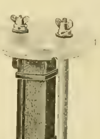


Fig. 2.

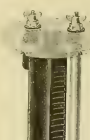


Fig. 3.

BADT HERMETIC CELL.

air tight open-circuit cell with oil seal and with oil insulation. The claims for this new cell are strikingly presented in the following list of negative qualities: No evaporation, no creeping of salts, no leakage of electricity, no premature disintegration of zincs, no trouble of any kind, no attention, no attendance, no repair bills. Finally, it is claimed that while it is "expensive in first cost" it is "cheap in the long run."

The manufacturers of the Badt hermetic cell direct attention to many of the failings common to cells of this class which it is claimed are overcome in the Badt cell. All who have had experience in handling primary batteries realize the annoyance caused by evaporation of the liquid and the creeping of salts. This creeping of salts is usually started by the evaporation of the liquid. If there is no creeping of salt, of course there will be no danger from short circuiting of the electrodes within the cell.

The advantage gained by maintaining a uniform level of the solution is easily seen by observing a wooden post driven into the river. The wood will rot there where it is exposed alternately to the air and to the water, namely, near the surface of the water. A similar action takes place in an electric cell where the zinc often is found eaten through and used up only where the gradual sinking of the level of the solution has exposed portions to the influence of various chemical and electro-chemical agencies. Experience shows that with the surface of the solu

tion kept at the same level, this zinc-destroying effect will not take place. The oil seal absolutely insulates the glass cover from the jar, and as no salt can creep over the oil, the cover with its electrodes may be said to be insulated by means of an oil insulator from the jar and from earth. The cover, being of glass, insulates the electrodes from each other.

Fig. 1 represents the glass jar without cover, showing a part broken away, disclosing the channel or trough surrounding the upper edge of the jar. This trough in practice is filled with oil. Fig. 2 represents the glass cover with electrodes of cell No. 1 (hermetic prism cell). The cover is provided with two rims or flanges. The inner flange rests in the oil trough and the outer flange surrounds the top of the jar and prevents dust from getting into the oil trough. There are three notches at the lower edge of the inner flange to prevent the displacement of the oil in the trough by either internal or external pressure due to the electro-chemical action in the cell. Each electrode (zinc and carbon) has a shoulder carrying a metal terminal which passes through a hole of the cover, and soft rubber washers are placed on these terminals below and above the glass, in order to make the holes air-tight. Fig. 3 represents the glass cover with electrodes of Cell No. 2 (hermetic cell without prism or chemical depolarizer). The glass cover is identical with that for cell No. 1, so is the zinc; the carbon, however, is of a peculiar shape and has no prism (chemical depolarizer) attached to it.

This cell is placed on the market by Meysenburg & Badt of Chicago.

Extensive Railway Project.

The City Council of Kenosha, Wis., passed an ordinance at its last meeting granting a franchise for an electric railway through that town. This line will form a part of the system of trolley lines that it is proposed to build in Illinois and Wisconsin, and it is now claimed that a right of way has been secured between Chicago and Green Bay, Wis., a distance of 201 miles. The proposed line will parallel the Milwaukee division of the Chicago and Northwestern Railroad company.

The promoters say that by far the greater part of the route is covered by tracks, and that the Kenosha franchise was the last required to complete the right of way. About 60 miles of the track of the Fox River line, connecting Milwaukee and Green Bay, was laid last summer and fall, and many miles of construction work were completed during the winter. The Milwaukee, Racine and Kenosha electric railway is in operation from Milwaukee to the Kenosha city limits on the north, covering a distance of 35 miles. Another piece of the system is an electric line connecting Waukegan and North Chicago, lying four miles to the south of Waukegan. Between Waukegan and Evanston a good many miles of track have been laid. The distance from Evanston to Chicago, as is well known to Chicago people, is covered by the Chicago North Shore Electric and the Chicago, Milwaukee and St. Paul. Though the latter road is to be operated by steam, it is soon to be equipped with electricity, so that an entrance to Chicago from Evanston can probably be secured without great difficulty.

The charter of the Milwaukee, Racine and Kenosha road permits the carrying of passengers, baggage and express, and it is understood that the Fox River line between Milwaukee and Green Bay intends doing a freight business also. Its passenger cars are almost as heavy as an ordinary steam-railway coach and they are equipped with motors of double the power of those used on the ordinary electric railway coach. The Milwaukee, Racine and Kenosha company is now operating nine cars, one every hour, between Milwaukee and Kenosha. It charges half the fare of the Chicago and Northwestern, but the service is much slower.

The Kenosha franchise provides for a local system requiring the construction of about five miles of single track in addition to the laying of the tracks to be used by the through line.

Public Service in Indianapolis.

The Indianapolis council committee on contracts and franchises met in private session March 3d to consider an ordinance which makes sweeping reductions in the price of electric lights. W. L. Taylor, the lighting company's attorney, was present and addressed the council, contending that the company has a fixed franchise for four more years, at the end of which time any regulation that the city deems right may be imposed, and that the fact that the company pays a percentage of its earnings into the city treasury, which no other company enjoying public rights does, should entitle it to some consideration. No action was taken.

The council committee on public safety and comfort killed Mr. Schaffer's ordinance requiring at least ten electric bells on every street car with which to signal the motorman. Two members held the opinion that these bells would probably lead to an abandonment of [illegible] whom they regarded as very useful functionaries. One member said he went to Chicago to ask about a similar ordinance there, and was told by street car men that it resulted in endless confusion and many unnecessary stops, owing to mistakes of those who did not know how to operate the bells properly.

Amateur Model-making Competition at the New York Exposition.

A committee consisting of Prof. Morris Loeb, Dr. C. A. Doremus, Dr. W. E. Geyer and T. C. Martin has drawn up rules and regulations for an amateur model-making competition in connection with the electrical exhibition to be held in New York in May. Printed forms can be had from the management, 15 Cortlandt street. The classes are given below, each class having prizes not to exceed $50 and bronze medals, the exhibits to be judged by a committee of five well-known men. It is believed that the contest will awaken general interest and elicit some beautiful and interesting apparatus. There are a great many young people and students who find pleasure in handiwork of this character. The exhibits must be entered a week before the exhibition begins. The classes are as follows:

Class A—Working model or actual machine of a dynamo-electric or electro-dynamic type, made by one or more boys under 21, so far as designing, lathe work, assembling and finishing is concerned.

Class B—Instrument of precision, made by amateur or student, including galvanometers, resistance bridges, etc.

Class C—Practical application of electricity to communication, the assembling and finishing to have been the work of a single exhibitor.

Class D—Ingenious application of electrical appliances to domestic, etc., uses by an amateur under 18; none of the apparatus to be necessarily of home manufacture.

Class E—Design or working drawing of an electrical appliance or installation, made within the past twelvemonth by a student of a recognized chartered institution, and bearing the instructor's certificate as to its bona fides.

Class F—Design or instrument made by a teacher, below the grade of college professor, for illustrating some electrical law.

CORRESPONDENCE.

New York Notes.

New York, March 14.—By a decision of the Appellate Division of the Supreme Court, handed down on Friday, the Rapid Transit Commission is placed in a much better position with reference to its tunnel plan of rapid transit. The court had held that the contractor for the road must furnish a $15,000,000 bond, but this requirement is now interpreted to mean that only $1,000,000 of the bond shall be a continuing security during the whole life of the contract, the other $14,000,000 being required to cover the period of construction and equipment. This judicial interpretation makes it much more likely that bids to build and operate the road will be received. A. B. Boardman, one of the counsel for the Rapid Transit Commission, said that he considered the decision as an important victory for the underground tunnel plan. He saw no reason why the commission should not in due time proceed to advertise for bids for the contract, and was confident that there would be no difficulty in securing trustworthy and responsible contractors to furnish the $14,000,000 bond for the period of construction and the continuous bond for $1,000,000. Mr. Delafield, the secretary of the commission, thinks that the bond, as now provided for, is not prohibitory. He stated that he could not say how soon the commission would act in the matter or when its next meeting would take place. Mr. Delafield said that the decision would in no way affect the matter of the application of the Manhattan Elevated Railway company, which would be decided upon its own merits. He added that the Rapid Transit Commission would probably move definitely within a week or 10 days.

What is an "electrolysis sanitarium?" I am moved to ask the question by this item in a daily paper: "John L. Baker has been appointed receiver for Dr. Fort's Electrolysis Sanitarium by Justice Fursman of the Supreme Court in proceedings begun several months ago for the dissolution of the corporation. The assets are $476 and the liabilities $150. Mr. Baker was vice-president of the concern." Perhaps some of the western electrical men can answer the question.

P. H. Flynn, the Brooklyn trolley magnate, who recently caused the Coney Island and Brooklyn Railroad company to be permanently enjoined from executing a mortgage on its property amounting to $1,500,000, has obtained a temporary injunction from Justice Dickey of the Supreme Court, preventing the company from increasing its capital stock from $1,000,000 to $2,000,000, or from issuing or exchanging any such shares of stock. Mr. Flynn averred in his complaint that it was intended to manipulate the securities to the detriment of the minority stockholders. This litigation will have the effect of postponing the proposed consolidation of the Coney Island and De Kalb avenue roads, and may, it is said, block it altogether. The roads have been operated jointly under a lease for nearly a year, and the plans for consolidation were about perfected a few weeks ago.

E. H. Lewis, representing the Edison company of this city, appeared before an Assembly committee recently in opposition to "Young Tim" Sullivan's bill fixing the price per hour for incandescent lights at three-quarters of a cent and for arc lights at four cents. It developed that "Young Tim" did not know the prices now charged, and the committe was amused when Mr. Lewis showed that the average price charged for these lights was lower than the prices fixed in the Sullivan bill. Mr. Lewis asserted that there was no demand for the measure from anyone but "Young Tim" and his cousin, "Big Tim," the senator, who has introduced a similar bill in the Senate.

The annual meeting of the Long Island Electric Railway company was held last week and the following-named officers were elected for the ensuing year: President, A. R. Hart of Brooklyn; vice-president, Charles A. Porter of Philadelphia; treasurer, William L. Wood of Jamaica; secretary, J. C. von Arx of Brooklyn. The following-named directors were chosen: Charles A. Porter, Jr., of Philadelphia, F. M. Harris of Philadelphia, A. G. Greenberg and Joseph Hogan of New York and H. A. Van Allen of Jamaica. M. S.

Canadian Intelligence.

Ottawa, March 12.—Two companies will apply to the Canadian Parliament, at its present session, for charters to supply electricity and run electric railways above Dawson City and throughout the Yukon district generally.

The promoters of the St. Thomas (Ont.) street railway have let the contracts for construction work, and they hope to have the road in operation early in the summer. At a meeting held last week the company authorized the issue of debentures for the amount of $50,000.

The Dawson City Electric company is applying to the Dominion Parliament for an act of incorporation. The company asks to supply electric light, heat or power throughout the city, and within a radius of 200 miles, as well as to operate an electric tramway.

J. D. Oligny, contractor of Montreal, is an unhappy inventor. He had spent much time on the invention and construction of an incinerator, and a public test was to have taken place this week, but previously a fire started in an old slaughter house at Cote St. Paul, where the incinerator was housed, and now nothing is left of it but a wreck. Mr. Oligny represented that he could destroy garbage by means of electricity and a certain solution which hastened decomposition. It did not matter whether the garbage was ashes, metal or stone, all would be destroyed, but the inventor did not make his incinerator fireproof, with the result noted. Mr Oligny expects to repair the machine for a proper test.

The Dominion government will be asked to make an appropriation, at the present session of Parliament, for the extension of the government telegraph system to the Yukon country. At the present time the government telegraph line extends from Ashcroft, B. C., to Quesnelle, a distance of 225 miles. From the latter point to Telegraph Creek is 54 miles. The proposal is to build the section to Teslin Lake next season, reaching the Yukon in 1899. The cost is roughly estimated at $500,000.

The Canadian Pacific Railroad Telegraph company now proposes to stretch a copper telegraph wire from Montreal to Vancouver, B. C. It will then be possible to sit in the Montreal office and transmit messages to Vancouver direct. The wire to be used will weigh 300 pounds to the mile, and the total weight of copper wire to be used will be something like 450 tons. Work is expected to be begun on the new line on the 1st of April next, and it is hoped to have the line completed and in working order by the 1st of June. Construction work will commence at the Montreal end. The copper wire to be used in the enterprise will cost in the neighborhood of $250,000. The wire will be worked duplex.

Quebec's electric street railway is about to change hands. It appears that when H. J. Beemer transferred the franchise to the present company he retained a two-years' option of the property, which he now insists on availing himself of. It is said that the company offered $300,000 to buy out his right, but that he demanded $350,000, which it would not pay, and now he is about to redeem the property, paying the company 10 per cent. premium on the cost of construction and six per cent. interest on the money invested, as agreed at the time of the transfer. It is understood that the returns of the road have been so handsome that Mr. Beemer has found no difficulty in selling to another company, which will also take over the Quebec and Montmorency railway, consolidating the two lines and running them both by electricity. A. V. W.

Northwestern Notations.

Minneapolis, March 14.—The town of Alden, Ia., may secure electric lights soon, as there is a man with capital ready to put in a plant as soon as a franchise is granted.

O. B. Durdall has made a proposition to the council of Algona, Ia., to establish an electric-light plant, and the city will vote at the city election on granting him a franchise.

The council of Duluth, Minn., will proceed at once to carry out the platform on which it was elected, the ownership of all municipal franchises. A committee has been appointed to negotiate with the Commercial Light and Power company and the Duluth Light and Water company, the latter operating in West Duluth, for the purchase of their

franchises. The committee was given power to draw plans for paralleling both systems in case the companies refuse to sell at a price that meets the idea of the committee.

It has been erroneously reported that Mitchellville, Ia., will bond itself for $10,000 for an electric-light plant.

Bittner & Lynch have been granted a franchise at Heron Lake, Minn., for an electric-light plant.

The project of an electric-light plant for West Point, Ia., is being agitated.

Gaylord, Minn., voted for electric lights by almost two to one.

The stock in the Mankato Gas and Electric Light company at Mankato, Minn., held by R. D. Hubbard, has been turned over to John B. Meagher, by Mr. Hubbard's assignee, George M. Palmer. The Gas and Electric company proposes now to expend $10,000 this season in improvements to its plant.

On March 28th the city of Boone, Ia., will vote on establishing a municipal electric plant.

The Fox River Valley Interurban Railway company has completed a survey for its proposed line from Neenah to Oshkosh, Wis., 13 miles. The line is to be part of a road that is eventually to be extended to Milwaukee. The line between Neenah and Appleton is expected to be in operation by April 1st.

W. J. Bonwell of St. Paul has gone West to put in the electric-lighting plants for the Cascade tunnel being constructed near Seattle, Wash., for the Great Northern railway.

A slimly attended mass meeting in Red Lake Falls, Minn., declared in favor of an electric-light plant. Marcus Johnson is an applicant for a franchise, and proposes to run a plant in connection with the flour mill. C.

PERSONAL.

Mr. C. D. Crandall, the general manager of the Western Electric company, has returned from his southern trip.

A. C. Garrison, secretary and treasurer of the Columbia Incandescent Lamp company of St. Louis, is in the East on business connected with the company in New York, Baltimore and Pittsburg.

Mr. E. E. Keller, the vice-president and general manager of the Westinghouse Machine company of Pittsburg, delighted his Chicago friends by a visit during the week. Mr. Keller was accompanied by Mr. T. L. Brown, the treasurer of the company, and the gentlemen inspected the factory at Craigin.

Henry L. Doherty, general manager of the Madison (Wis.) Gas and Electric Light company, was in Chicago last Saturday. Mr. Doherty is spending considerable time in Columbus, Ohio, where the interests with which he is associated have recently gained control of the electric-lighting business.

James W. Johnson is again connected with the Chicago office of the General Electric company, acting as special agent. Mr. Johnson is one of the well-known electrical men of the West, having an electrical experience in Chicago dating 10 years back. From 1888 to 1894 he figured prominently in the western business of the Thomson-Houston and General Electric companies, having charge of the lighting department of the latter at the time of his resignation four years ago. Mr. Johnson has taken an honorable part in the electrical development of the West, and now that he is back among old friends he may be depended upon to actively participate in the work of extending the general electrical trade with returning business prosperity.

ELECTRICAL SECURITIES.

The Edison Electric Illuminating company of Brooklyn reports gross earnings for February $75,601, an increase of $5,783; operating expenses, $38,975, an increase of $1,160, and net earnings $36,625, a gain of $4,622 over February of 1897.

The minority stockholders of the Wilmington City Electric Railway company have accepted the proposition to sell their stock to the Clark syndicate at $13 a share, payable in five per cent. gold bonds, and the deal has been closed.

At the meeting of the stockholders of the Allegheny County Light company of Pittsburg it was voted to increase the capital stock from $1,500,000 to $2,500,000. The increase is to be applied to extending the company' lines, enlarging the plant and for general betterments.

The Bridgeport Traction company reports gross earnings for February of $21,671, an increase of $188 as compared with the same month of last year, and net $7,117, an increase of $1,003. For the eight months ended February 28th the gross earnings were $222,073, an increase of $6,950 as compared with the corresponding period of last year, and net $103,835, an increase of $16,840.

A mortgage for $750,000 has been given by the Union Light and Power company of Salt Lake City to the Central Trust company of New York. The mortgage covers all the real and personal property, improvements, lighting and power plants, pole lines and franchises of the Union Light and Power company, and is given to secure the payment of 750 consolidation mortgage bonds of the denomination of $1,000 each, bearing five per cent. annual interest, due in 20 years at 105. The money will be used to take up old bond issues bearing six per cent., and for improvements to the company's properties.

A gentleman identified with the Union Traction company of Philadelphia says that since March 1st the daily gross receipts of the system have been $2,500 ahead of last year. For the eight months of the fiscal year, or up to the close of February, the company earned within about $75,000 of the charges for that period. The net earnings for the period are a gain of about $600,000 over the corresponding eight months of 1896-97. The gentleman says that February is one of the worst months of the year, and that with the four good months following there is excellent prospect that Union Traction will show for the year ending June 30th something earned over fixed charges as compared with a deficit last year of $850,000.

The report of the Western Union Telegraph company for the first quarter of 1898, ending March 31st, shows net revenues based upon nearly completed returns for January, partial returns for February and estimated business for March, of $1,200,000, which, added to surplus of $8,023,239.88 on hand January 1, 1898, makes the total amount available $9,223,239.88. From this amount there is appropriated for interest on bonds $224,420 and for sinking fund $9,991, a total of $234,411. In addition to this amount there is required for the dividend of $1\frac{1}{4}$ per cent. on capital stock issued about $1,216,980, which leaves a total net surplus, after these deductions, of $7,771,848.88. For the purpose of the quarterly dividend, to be paid on April 15th, the books of the company will be closed March 18th, and will reopen on the morning of the first day of April next.

TRADE NEWS.

The report of the Chicago Electrical association committee on standard diagrams has been published in concise, convenient form for the use of electrical draftsmen and patent attorneys. Application for copies should be made to J. R. Cravath, secretary of the organization.

W. R. Garton, 414 Ashland block, Chicago, has been appointed western representative of the Keystone Electrical Instrument company of Philadelphia. The Keystone company has been rushed with business since the first of the year, and is preparing to increase its facilities.

"The rapid growth of our business is the strongest evidence of the superiority of our mica," appears as a preface to the 1898 catalogue of mica specialties which has been mailed to the electrical trade throughout the United States by Eugene Munsell & Co. of New York and Chicago.

J. W. Hull, representing the Cabinet Manufacturing company of Steubenville, Ohio, is stopping at the Palmer House, Chicago. Mr. Hull is energetically pushing the interests of his company and has met with flattering success. The company manufactures woodwork for telephone manufacturers and others, and it is said that it turns out none but the best work. Mr. Hull has already secured a number of Chicago orders.

It will be interesting to the readers of the Western Electrician to know that Mr. E. J. Wessels, who for several years was general manager of the Standard Air Brake company, has recently become proprietor of a weekly journal, which will be called the Universe, being devoted to business men and women, and covering the various important subjects of the day, with a number of important departments, covering the arts and sciences. The first issue presents a number of interesting articles and argues well for the future success of the venture.

H. M. Grant, who for the past 18 years has been general sales agent for the Vulcanized Fiber company, severed his connection with that concern on February 1st and accepted a similar position with the American Hard Fiber company of Newark, Del. Mr. Grant is known in every branch of the electrical trade, having traveled from the Atlantic to the Pacific Coast, and personally called upon the various concerns who use hard fiber. Success has attended his efforts, as is shown by the business which the concern he was formerly connected with has secured. The American Hard Fiber company is to be congratulated in securing the services of a gentleman who is so justly popular, and he will undoubtedly achieve a continuation of his former success in his new business connection.

Independent telephone companies will be interested in the announcement of the Hawkeye Telephone Construction company which has been formed to build and equip telephone exchanges and toll lines. The company says: "To successfully compete with the Bell monopoly, you must furnish the best service possible. We will construct your exchange complete, from conduits and poles to switchboard and telephones, or will install either the central office or outside system separately. We will operate plants constructed by us for 30, 60, or 90 days, in order to give you satisfactory proof that our work, which will be done under the personal supervision of C. W. Barthen, is of the very best." Estimates will be furnished for switchboards, telephones, toll lines, overhead and underground systems, in part or complete. The company has offices at Chicago and Des Moines.

The Davis & Egan Machine Tool company of Cincinnati, Ohio, has just received through its office at Berlin, Germany, orders from the Gewerkschaft Deutscher Kaiser at Bruckhausen (Rhenish Prussia) for 14 machines, including lathes, planers, shapers drill-presses. This is the largest steel works in Germany. The Cincinnati company has also received through the same office an order from the Internationale Bohrgesellschaft for 12 lathes and 12 drill-presses. The company is now running its Cincinnati plants day and night, and the plant which it recently purchased in Covington, just across the river, will be in full operation within the next two weeks.

The Peru (Ind.) Electric Manufacturing company is again preparing for the erection of another one and two-story building. It is to be 25 feet wide and 70 feet long. The structure will be made of brick with either an iron or a slate roof. The clay bins will be moved into the new building and the space made vacant will be filled with porcelain presses. The two-story part of the new building will be made fireproof, to contain all the dies used in the business. A porcelain kiln, surrounded by an ironclad building 30 feet square and one story high, has just been completed and will soon be pressed into service. This makes five kilns for the works. At present the company is enjoying a boom in trade and has a force of nearly a hundred persons at work. The present officers of the company are: President, J. O. Cole; vice-president, C. H. Brownell; secretary and treasurer, R. H. Bouslog; directors, R. A. Edwards, J. O. Cole, C. H. Brownell, J. G. Brackenridge, William Levi and William B. McClintic.

The management of the International Correspondence Schools of Scranton, Pa., has exhibited its customary enterprise in a new plan of calling public attention to the work of the schools. A handsome railroad car for the schools will shortly be sent on a tour through the principal manufacturing cities of the country. The length of the body is 50 feet and the width nine feet and eight inches over the sills. It contains a reception room, 18 feet long, furnished in quartered oak and fitted with bookcases, center table, wicker chairs, couch, carpet, curtains, etc. There are four sleeping sections of upper and lower berths, eight in all, occupying 12 feet six inches of the length, giving sleeping accommodations for eight persons. There is a storage room for books, and a saloon. The president of the schools, Mr. R. J. Foster, will be in charge of the car on its initial trip. His assistant, Mr. John G. Forsyth, will be in charge of the corps of six representatives, who will accompany the car. The plan of work proposed to be followed is to locate the car for a time in the immediate vicinity of large manufacturing establishments and afford to those interested a practical demonstration of the methods in which the work of the schools is carried on.

BUSINESS.

A little battery catalogue has been issued by the Peru Electric Manufacturing company of Peru, Ind. New types of Laclede and Hercules cells are shown.

The K. & W. company of Pittsfield, Mass., reports a rapidly increasing demand for its cut-outs, hanger-boards and dynamo brushes. Testimonials show the high regard in which these specialties are held.

The Pacific Electric company of La Crosse, Wis., advises its friends to color their own incandescent lamps with "Karsline;" to etch their own lamps with "Inline" and to finish their own fixtures with "Playtone." A circular giving prices and information is sent on request.

William C. Hubbard, vice-president and general manager of the Electric Arc Light company of New York, has just returned from a month's trip through the West and Northwest. Mr. Hubbard booked some good orders while away, and made a number of valuable connections for the "Pioneer" company.

Excellent catalogues of automatic switches, motor starters, knife switches and switchboard fittings are issued by Zindars & Hunt, manufacturers of electric-light and power specialties, 127 Fifth avenue, New York. The marbleized covers of the pamphlets are striking, and the contents are well arranged with very good illustrations.

Hans Swoboda, the electrician of the General Incandescent Arc Light company of New York, has been producing excellent results with an alternating enclosed arc lamp upon which he has been at work for a long time. The high state of perfection that he has attained for this lamp reflects great credit upon his ability in this class of work.

The D. A. Kusel Telephone and Electric Manufacturing company of St. Louis has received the contract to furnish the Farmington Telephone company at Farmington, Mo., with a 100-drop switchboard and 80 telephones. Thirty-five of the D. A. Kusel long-distance telephones have been sold for the line from Mokane to Jefferson City, Mo.

There has been some criticism by several men living north of Chicago in regard to the Western

Electric company advertising a swinging tree insulator when the snow was on the ground, but now is the time for at least 50 per cent. of the central stations in the United States to look after their outside lines and prevent them from coming in contact with trees.

The Hartford City Gas Light company of Hartford, Conn., has placed another contract with the Berlin Iron Bridge company of East Berlin, Conn., for one of the latter's steel roofs lined with patent anti-condensation fireproof roof lining, which has given the Gas Light company eminent satisfaction in the past. The new building is about 35 feet wide and 70 feet long.

On request the Farr Telephone and Construction Supply company of Chicago will send without charge its combined catalogue and hand-book of telephone information. This little book contains practical instructions about the building and maintenance of telephone exchanges and lines, with diagrams of connections, weight and resistance of wires, building estimates, information about patents, etc.

Superintendent H. T. Knight of the Connecticut Telephone and Electric company of Meriden, Conn., accompanied by the electrician of the company, C. E. Egan, has been visiting in New York for several days. The gentlemen named will also visit other eastern cities before they return to Meriden. They report that their concern has been rushed with orders during the last six months, and now extensive preparations are being made to take care of double the amount of business which was handled during the last year. The excellence of the products of the Connecticut Telephone and Electric company is well known.

The Joseph Dixon Crucible company of Jersey City, N. J., points out that it is the slipping belt that wears the leather. Belts that slip not only do not drive properly, but they wear out rapidly. A belt that is too tight is overstrained, and will also wear out rapidly. A thoroughly reliable belt dressing is therefore a necessity in every well-regulated factory, and perhaps no dressing has such a world-wide reputation as Dixon's belt dressing and leather preservative. As long ago as 1878 it was used on the big driving belt at the Paris Exposition, when every other means had failed to make the belt take hold of the pulley that was to start the thousands of feet of shafting and hundreds of machines. Those who use Dixon's belt dressing claim that it prevents slipping and thoroughly preserves the life and elasticity of the belt.

The electric-light plant now being placed in the new building of the Peruna Drug Manufacturing company at Columbus, Ohio, consists of two Ball engines of 160 horse power, built by the Ball Engine company, Erie, Pa., direct-connected to Siemens-Halske dynamos. The City of Erie is the name of a new passenger steamship building at Detroit for the Cleveland and Buffalo Transit company. This boat, which will be one of the most handsomely fitted on the great lakes, will have a large and complete direct-connected electric-light plant, consisting of Ball engines, built by the Ball Engine company, Erie, Pa., and dynamos built by the Fuller company of Detroit, Mich. The Shenango Valley Steel company, New Castle, Pa., is now installing a 450 horse power Ball engine, built by the Ball Engine company, Erie, Pa. The engines are belted to Westinghouse generators, and are used to generate power for electric cranes, electric lighting and kindred purposes.

Although many of the alternating-current stations have no day circuit and consequently have not thought it worth while to investigate the possibilities for revenue in the introduction of fan motors, yet it is on the hot and sultry evenings that the drug store, the soda-water fountain and the ice-cream parlor do their most thriving business. No matter how carefully these places are kept, as long as they have light it is impossible to prevent flies and other insects coming into the rooms unless the air is kept in motion. A ceiling fan motor, in addition to being an ornament, will not only keep the rooms free from flies and insects of all description, but will give a cooling breeze to the patrons of the places using them. The Western Electric company is agent in the West for the Tuerk alternating-current ceiling fan. This fan has been in operation for several years and has proved to be a satisfactory device both mechanically and electrically. All central-station men who are wide awake and looking around for means of increasing the revenue of their stations should investigate the merits of this fan.

The Mica Insulator company of New York, Chicago and London announces that it has recently made an addition to its already extensive line of oiled cloth and paper insulations, and is now prepared to furnish M-I-C compound, rope and bond paper. This line of insulation is made from the finest grade of rope and bond paper and treated with two baked coatings of M-I-C compound. The rope paper is furnished in sheets one yard wide, two yards long, and carefully packed between sheets of plain paper. The average breakdown test is 739 volts per mil; thickness, 4½ mils. The bond paper is furnished in sheets 19 by 24 inches and 22 by 34 inches, the average breakdown test being 859 volts per mil; thickness, five mils. The company will be pleased to send samples to electrical manufacturers, street railways or lighting stations upon application.

In addition to the contract recently secured from the city of Chicago, Sipe & Sigler of Cleveland, manufacturers of the Willard storage battery, report having delivered 58 cells to the Washburn Memorial Orphan Asylum, Minneapolis, Minn.; 64 cells to the Eclipse Electrical company, St. Louis, Mo.; 80 cells to the American Incandescent Lamp company, Warren, Ohio; 50 cells to M. A. Seed, St. Louis, Mo.; 28 cells to Prof. C. H. Wing, Ledger, N. C., and 38 cells to the Riker Electric Motor company, Brooklyn, N. Y. These batteries are to be used in connection with isolated plants. For telegraph and telephone purposes 100 cells were sold to the Home Telephone company, Cleveland, Ohio; 40 cells to the American District Telegraph company, Cleveland, Ohio, and several small orders to the Western Union Telegraph company. The horseless-carriage trade is brisk, and Sipe & Sigler have received within the last two weeks orders for 700 horseless-carriage cells, among the purchasers being the Riker Electric Motor company, Brooklyn, N. Y.; the United States Carriage company, Chicago, Ill.; the C. H. Barrows company, New York; Montgomery Ward & Co., Chicago, Ill., and the Gugler Electric company, Minneapolis, Minn.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued March 8, 1898.

600,134. Electric Locomotive. Harry Bitner, Chicago, Ill. Application filed June 19, 1896.

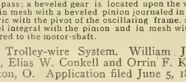
A frame is provided with a suitable motor for its propulsion, and a pair of supporting wheels, a shaft connecting the wheels, an oscillating frame carrying the shaft and provided with suitable pivots substantially in a line at right angles to the wheel shaft through the center of which they pass; a beveled gear is located upon the wheel-shaft and in mesh with a beveled pinion journaled in a line concentric with the pivot of the oscillating frame, and a gear-wheel integral with the pinion and in mesh with a pinion secured to the motor-shaft.

600,202. Trolley-wire System. William J. Kauffman, Elias W. Conkell and Orrin F. Kauffman, Canton, O. Application filed June 5, 1897.

Claim is made for the combination of a support or pole having attached thereto a bracket or arm, the pivoted bar carrying a trolley wire, the wire connected to the pivoted bar and to the switch-bar, the wire arranged as described, the switch-bar pivotally attached and located between the clips and the emergency wire.

600,228. Polyphase-current Transformer. Carl Kurda, Nuremburg, Germany. Application filed November 5, 1896.

A transformer for polyphase alternating currents consisting of two or more sets of inducing coils of different



NO. 600,134.

phase placed one upon another, in combination with laminated sheet inductive material surrounding the sets of inducing coils and separating them from each other.

600,230. Electro-therapeutic Exercising Apparatus. Abraham Martin, Paris, France. Application filed November 23, 1897. Patented in France May 10, 1897.

A system of electro mechanical apparatus for exercising the muscles of the human body and thereby generating an electric action applicable to all or any part of the body is described, comprising a frame, shaft, pulley actuating a magneto electric generator, whose poles are respectively connected to the hand grips of crank handle, a brake-drum encircled by brake shoes, segments embraced by a cord connected to a spring balance and also to a regulating pulley adjustable by means of a notched lever to vary the tension of the cord and spring-balance.

600,252. Means for Arresting Motion of Electric Cars. Wilbur C. Anderson, West Hoboken, N. J. Application filed August 30, 1895. Renewed October 2[illegible], 1897.

A local circuit including the motor or motors and the reversing switch or switches, two car controllers, two circuit closers or switches, one operated by each controller, the contacts on the controller and on the switches being so arranged that when the main source of current is cut off from the motors the switches are closed, completing the local circuit.

600,265. Electrical Measuring Instrument. Adrian H. Hoyt, Penacook, N. H. Application filed July 2, 1897.

The electric measuring instrument has a graduated scale and a pointer whose movement thereon is caused by the current on the circuit, suitable mechanism for preventing a return movement of the pointer to zero should the current be diminished or stopped after having recorded the maximum load on the circuit.

600,277. Electric Arc Lamp. James H. Duncan, San Francisco, Cal. Application filed July 13, 1897.

A fixed upper frame or base carries the actuating magnets, with upper carbon and clutch mechanism therefor, a lower movable frame normally upheld by a spring carrying the lower carbon and acting as a trip for the clutch mechanism and connections, whereby the lower movable frame is controlled by the actuating magnets.

600,278. Automatic Switch for Railways. Howard F. Eaton, Quincy, Mass. Application filed July 13, 1896.

A conductor and a traveling contact are combined with an operating magnet and a circuit-controller establishing the circuit of the operating magnet, the circuit-controller being arranged in series circuit with the conductor-operating magnet and traveling contact, and responsive to currents of a predetermined characterization only.

600,285. Electric Heater. Richard J. Holland, New York, N. Y. Application filed December 24, 1896.

The flexible, liquid-holding receptacle is provided with a contracted mouth or aperture, and there is an insulating closure consisting of a screw-plug having a connected housing, one or more resistance coils within the receptacle and attached to the screw-plug, electrical connections to the coil or coils within the housing, and a switch also within the housing, and by means of which the electric current may be turned off and on as desired.

600,336. Insulating Connector. Herbert E. Pearce, Brooklyn, N. Y. Application filed May 18, 1897.

An insulating connector for electrical fixtures has a top bracket formed with a hub, whose opening is larger than the diameter of the supporting pipe or rod, and set-screws in the hub for attaching the connector.

600,356. Automatic Regulator for Electric Currents. Joseph D. C. Chateau, Paris, France. Application filed July 10, 1897. Patented in France May 30, 1896.

An automatic regulator for electric currents is described, comprising a magnet or coil, an armature, a resistance, two contact pieces between which the armature is arranged, and connections whereby the coil, the armature, the resistance and one of the contact pieces are in the main circuit, while the other contact piece is in a shunt circuit.

600,380. Galvanic Apparatus. George H. A. Schaefer, Buffalo, N. Y. Application filed January 7, 1898.

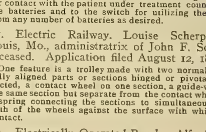
This apparatus consists of a cabinet having a lower compartment, an upper rear compartment and an upper front compartment, an angular cover for opening or closing the upper front compartment and a hinged side wall for opening and closing the lower and upper rear compartments, a number of batteries located in the lower and upper rear compartments, a series of metal plates located in the upper front compartment and successively connected to the batteries by negative wires, a series of positive wires successively connecting each battery with the next, a pivoted switch adapted for separate contact with the metallic plates connected to the batteries for increasing or lessening the electric current, and a positive and negative wire for contact with the patient under treatment connected to the batteries and to the switch for utilizing the current from any number of batteries as desired.

600,381. Electric Railway. Louise Scherpe, St. Louis, Mo., administratrix of John F. Scherpe, deceased. Application filed August 12, 1897.

One feature is a trolley made with two normally vertically aligned parts or sections hinged or pivotally connected, a contact wheel on one section, a guide-wheel on the same section but separate from the contact wheel, and a spring connecting the sections to simultaneously urge both of the wheels against the surface with which they contact.

600,383. Electrically Operated Brush. Alfred Sherwood, Topeka, Kan. Application filed March 1, 1897.

This is an electrical rotary brush, comprising the hanger having the integral arm and removable arm provided with handles, the motor having a frame whose tubular axis is fixed in the hanger-arm, the rotary motor-shaft passing through one end of the frame and having a pinion fixed thereon, the hollow brush proper inclosing the motor and



NO. 600,252

rotating on the frame portion and provided with the hub-gear, and the gear and pinion carried by hanger-arm and meshing respectively with the motor pinion and hub-gear.

600,417. Electric Heater. Edward E. Gold, New York, N. Y. Application filed August 12, 1897.

An electric heater comprising a helix of resistant wire coiled into a compound helix is combined with a support therefor, the helix being compressed against the support so that it exerts an expansive tendency.

600,457. Electrical Battery. Nathan B. Stubblefield, Murray, Ky. Application filed October 24, 1896.

A combined electrical battery and electro-magnet for use with water as an electrolyte, comprising a soft-iron core-piece and a voltaic couple of copper and iron wires insulated from each other and closely and compactly wound together in separate insulated layers to produce a solid coil body surrounding the soft-iron core-piece.

600,475. Electrical Insulator and Method of Making Same. John W. Boch, East Liverpool, O. Application filed October 23, 1897.

A porcelain or earthenware insulator is made of two or more parts fitted one within the other, with extra glaze introduced to fill all the spaces where the parts are to be united, and forming an intermediate solid layer or layers of glaze between the conductor and pin.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, MARCH 26, 1898. No. 13

Ice-bridge Formation at Niagara.

By Orrin E. Dunlap.

This year Niagara Falls has been treated to the rare spectacle of an ice bridge in March. It is the time of year that makes the formation most interesting, for Niagara ice bridges are usually the product of a thaw in the early days of January. Old residents at the Falls have come to look upon the first 15 days of the year as the ice-bridge time, and when the middle of the month goes by without a bridge forming they give up hope for the season. Ice bridges have formed at Niagara later than March, but their existence was brief, say a portion of a day or night. This year's bridge formed on the night of March 13th, and when the people awoke on the following morning they were surprised to learn of the existence of a bridge, ample in size and beautiful in outline. Its formation was just two months late, but despite this fact it was none the less welcome.

The views presented on this page illustrate this bridge as it was seen from the Gorge road. The pictures give a faithful idea of where the ice bridges form (Fig. 1), many pictures failing to do this. It will be seen that its location it at the foot of the falls, where the water is nearly 200 feet deep and the current is very rapid. People crossed back and forth on the icy mass, but the travel was not so great as in some previous years. The incline railways in the free parks on both sides of the river afforded easy access to the ice jam, and saved long walks up the stairways.

The other winter views presented show the Gorge road under snow. Fig. 2 is a view of the cut through which the road descends to the slope leading to the great bridges and rapids. Fig. 3 pictures the slope and view as seen in winter, while Fig. 4 looks still farther toward the rapids and shows the great new steel-arch bridge as it appears to-day, when viewed from the Gorge road.

In summer the Niagara gorge is beautiful from end to end, but under a heavy fall of snow its attractiveness is wonderfully increased, and it is admired by many who visit Niagara in the winter.

ICE-BRIDGE FORMATION AT NIAGARA.

Electrical Men Suffer Loss in a Chicago Fire.

Of several disastrous downtown fires in Chicago within the last week or so, the one that destroyed the Schoeneman building on Monday, although not marked by the distressing loss of life of some of the others, is of particular interest to the electrical fraternity, from the fact that a number of electrical men were among the tenants. The building was seven stories high and located at 303 and 305 Dearborn street, in the heart of the "electrical district." It was provided with power and the upper floors were rented to small manufacturing concerns. The fire started shortly after noon, and the building and contents were entirely ruined. The origin of the fire is not definitely known, but there appears to be no basis for the statement in some of the daily papers that it was caused by an electrical short-circuit.

Sargent & Lundy, the electrical engineers, had a storeroom in the basement, in which was a stock of 11 C. & C. motors, ranging from one-half to 10 horse-power, and 6,000 incandescent lamps. The apparatus was valued at $2,500, and it is feared that it is nearly a total loss. The insurance is $2,000.

On the second floor the Lovell Storage Battery company had its office and plant. This company manufactures bicycle and carriage lamps and physicians' electrical outfits. It lost everything except the papers in the safe, which, it is hoped, may be found uninjured when the debris is overhauled.

Mr. C. E. Lee is in England at the present time on business connected with the company, and the establishment was in charge of Mr. L. W. Collins, who says that the business will undoubtedly be resumed in a few days. The loss is placed at $1,500, to offset which there is insurance amounting to $1,000.

About six weeks ago the newly organized Rae Motocycle company established a workshop on the second floor of the building for the manufacture of storage batteries for vehicles, and it has lost property valued at about $500, with no insurance. A quantity of the personal effects of Frank B. Rae, the vice-president of this company, was stored in the shop and was destroyed. Mr. Rae is of an inventive turn of mind, and his belongings consisted of three-phase experimental apparatus, a complete electrical cooking outfit, elevator-starting mechanisms, electrical designs and other paraphernalia of an electrical inventor. Much of the apparatus cannot be replaced easily, and it is difficult to place a valuation on the collection, but it was probably worth $2,000 at least. Mr. Rae had no insurance on this property. He was out of town at the time of the fire. This is not Mr. Rae's first experience with fire, as his Detroit shops were burned out about five years ago. The business of the Rae Motocycle company will not be seriously interrupted.

H. C. Porter, a storage-battery manufacturer, was engaged in the laboratory of the Rae Motocycle company and sustained a personal loss of $250, without insurance.

Thomas Wrigley, a machinist, who made toggle bolts and other appliances for electrical use, had a shop on the seventh floor. He lost all his tools, patterns and machinery, valued at about $2,000. It is said that Mr. Wrigley had no insurance.

Otto Pfau, an arc-lamp maker, had lately moved into the building, and he lost a small outfit.

Distortion Measurements in Sciagraphy.

By O. L. Schmidt, M. D., and W. C. Fuchs, E. E.

All experimenters with the X-rays observed very soon that a certain distortion of the shadow occurs whether it is observed by the fluoroscope or by the sciagraph; in fact, the fluoroscope shows this more plainly than the sciagraph, as by shifting the position of the tube, the fluoroscope or the observed object, strange distortions of the shadow on the screen can be produced at will and seen changing from degree to degree. When the object and fluoroscope are fixed, a displacement of the Crookes tube in any direction in space produces a change in the shadow.

When the tube is moved laterally the distortion is most evident on the opposite side of the shadow, and when the tube is shifted nearer or farther away from the object the shadow also changes. It becomes larger or smaller in inverse proportion to the distance of the tube, while the focus area remains stationary. It is evident that in sciagraphy the object is placed as close as possible to the sensitized plate, and that the center of the picture is put into the focus point either because this is the part we wish to examine most carefully or because the picture is large, so that we wish the periphery to have the unavoidable distortion equal at all points, thus giving symmetrical errors and allowing comparisons with the least possible erroneous deductions.

The object of our experimentation was to determine limits of this variation for practical purposes, so that we might give approximate information on distortion in sciagraphs where the distance of the tube and the thickness of the object are known. For accurate localization the instruments known as fluorometers have been introduced. The object is exposed to the rays in different positions and the shadow taken on the fluoroscope or the plate with the fluorometer adjusted according to the focus point. By triangulation the position of the object may then be computed.

To determine the focus point various methods have been introduced; these are constructed on the principle of bringing the tallic rods on a line into the strongest area of X-rays, so that but one shadow appears on the fluoroscope or sciagraph. We use a simple focus tube of the following dimensions: Lenght, 11 inches; diameter, four inches; distance between electrodes, six inches.

A distance of five centimeters from the anode to the plate has seemed to us suitable for most tubes. A test-box was constructed so that a series of brass rods, separated two centimeters from each other, could be arranged on level of 2, 4, 6, 8, 10 and 12 centimeters above the sensitized plates. Sciagraphs were then taken of these rods at the different levels. The center rod was always put into the exact focus point by the principle mentioned. That this can be done very accurately by the fluoroscope was shown on the sciagraphs, where only one clear shadow is visible on the focus line. By measuring the distances between the shadows on the plates, it was found that they varied uniformly according to the distance of the rods from the focus line and their distance from the plate.

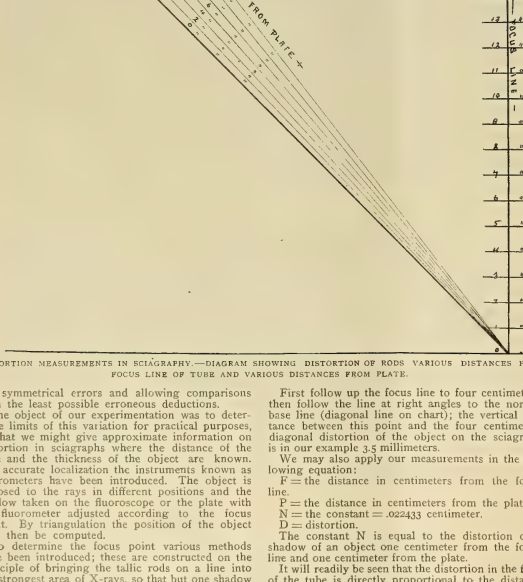
The results of the measurements of the different plates agreed so perfectly in their proper comparison with one another, that the accurate mean of these figures was easily obtained.

The sciagraph shows: First, the distortion is directly as the distance of the rods from the focus line; secondly, the distortion is directly as the distance of the rods from the focus plate.

From these priciples and the actual measurements, we have constructed a graphic method in the form of a curve, so as to readily determine the possible distortion of a shadow on the sciagraph. This is shown in the accompanying illustration.

The figures on the vertical line in the center indicate the distance from the focus line. The heavy diagonal line represents the sciagraph of the rods while placed on the plate, so that no distortion occurred. Above this heavy diagonal line there are diagonal lines marked in centimeters, to denote the distance of the rods from the plate; they represent by their distance from the normal base line the distance of the shadow.

Example: What distortion will an object have four centimeters from the focus line and four centimeters from the plate?



DISTORTION MEASUREMENTS IN SCIAGRAPHY.—DIAGRAM SHOWING DISTORTION OF RODS VARIOUS DISTANCES FROM FOCUS LINE OF TUBE AND VARIOUS DISTANCES FROM PLATE.

First follow up the focus line to four centimeters, then follow the line at right angles to the normal base line (diagonal line on chart); the vertical distance between this point and the four centimeters diagonal distortion of the object on the sciagraph is in our example 3.5 millimeters.

We may also apply our measurements in the following equation:

F = the distance in centimeters from the focus line.

P = the distance in centimeters from the plate.

N = the constant = .022433 cetimeter.

D = distortion.

The constant N is equal to the distortion of a shadow of an object one centimeter from the focus line and one centimeter from the plate.

It will readily be seen that the distortion in the field of the tube is directly proportional to the distance from the focus line and also the distance from the plate.

Example: What will be the distortion of an object eight centimeters from the focus line and 10 centimeters from the plate?

D=.022433×10×8.

D=1.79464 centimeters.

Thus we have a ready method of estimating the probable distortion on a sciagraph of an object of unknown position, in a body of known thickness where the focus line has been determined, and the distance of the tube from the plate is 50 centimeters.

B. W. Dinsmore has franchise for lighting the city of Marion, Va., and will erect plant of 400 incandescent lights of 16 candle power each.

Direct-coupled Set.

A direct-coupled engine and dynamo now on the European market which has been designated the Mertz-Alioth is shown in Fig. 1 (page 181), reproduced from l'Industrie Electrique. The advantages claimed for the combination are a compound engine coupled to a small dynamo, all of such reduced dimensions as to permit its use in very restricted quarters. The total length of the combination is two meters and the height of the engine one meter. The dynamo is .6 of a meter high, and the respective widths of the two are .8 and .6 meter. The total weight of this machine is 1,740 kilogrammes, and it is rated at nine horse power.

The engine is compound, has an effective steam pressure of eight kilogrammes per square centimeter, with one high and one low-pressure cylinder, whose diameters are respectively 170 and 260 millimeters. The two pistons, mounted on the same crank-shaft, give 520 revolutions per minute, and by the peculiar arrangement of the cranks and a cushioning of steam in the cylinder the trepidation and shock is completely overcome and the motion is uniform under all loads. The principal moving parts, as shown in the sectional view, Fig. 2, are all concealed, which permits of liberal oiling of the cylinders, while some other portions of the machinery are supplied by a pump, actuated by the machine itself. The regulator is of the centrifugal pattern, which governs the admission of steam into the steam chest, whence it passes into the cylinders, and this, being also inclosed, is lubricated in the manner already described. A heavy balance wheel, shown in the cut, aids in regulating the action of the engine and dynamo.

The dynamo coupling is screwed directly on the face of the balance wheel. This generator delivers a continuous current of 125 volts tension, and its industrial efficiency is 88 per cent. Its magnetic field, formed of four poles, is fed by four spools connected in pairs upon two derivations from the brushes. The air space is four millimeters. The cylinder has a diameter of 248 millimeters and the opening between the jaws of the magnets is 252 millimeters. The speed of the revolving portions is 675 meters per second.

It will be noticed that the combination throughout closely follows American apparatus that has long been on the market.

Central Power Plants on Board Ship vs. Distribution of Power.[1]

By William S. Aldrich.

There are certain inherent advantages in centralizing the generation of power for any given purpose. In almost all cases the original sources of power for the purposes under consideration are the steam engine and boiler plants. In all cases of the use of steam it has been long known and practiced, as well in its generation as in its utilization, that greater economy is to be effected by a centrally located plant. However, when it relates to the transmission and distribution of power from such central steam plant as are at once confronted with the claims of three principal rivals, namely, compressed air, water pressure, electricity. In particular, on board ship, we believe there will be reduced cost of installation, increased economy of operation, fewer men required in operation and management, if all the power required for the several auxiliaries should be developed in a single power plant. The same principle has been fully worked out in the mechanical equipment of modern office buildings, hospitals and other public institutions, department stores and isolated plants.

Only one working fluid is actually required for all cases of power distribution. If we are permitted for a moment to speak of electricity after the manner of the old school and to consider it as a working fluid, then it is quite clear that all of the auxiliary machinery on board a naval vessel may be operated by any one of the working fluids—steam direct from the boilers, compressed air, water pressure or electricity. Moreover, only one working fluid is actually required.

All the various operations now carried on by so-called "mixed systems" of power distribution on board ship can be effectively reproduced and satisfactorily performed by suitable motors and mechanisms driven by any one of the working fluids already mentioned. Primarily, of course all power for such distribution is to be derived from steam engines. Therefore the efficiencies of transformation of energy in each of the above cases should not be left out of consideration. It is not our present purpose to enter the discussion respecting such efficiencies of transformation involved in converting steam power into compressed air, water pressure or electricity.

For all the purposes, therefore, for which power may be required on board ship it may be developed:

(1) In a centrally located plant. This should, of course, be as near the battery of boilers and main engines as possible, placed in the same or adjoinwater tight compartments, and all below the protective deck.

(2) At points where the power is to be utilized. In this case several power-generating plants require to be located in different parts of the ship, being

1. Journal of the American Society of Naval Engineers.

most suitably installed at or near the centers of distribution. In this case, however, it must be remembered that steam from the boilers is the original source of energy for the distributive development of power. All prime movers for any system of power generation on board ship are and will continue for a while to be of the various types of simple and compound steam engines.

Should the power required at any point be developed elsewhere in a central plant and transmitted to that point for direct utilization? Or should such power be generated by a steam engine on the spot and further transformed into compressed air, water pressure or electricity, as may be required for application at such point? It will be seen that the whole problem resolves itself largely into a question of the distribution of power. The distances for such distribution are so short on board ship that there is practically no necessity for considering any of the so-called line losses in power-transmission work. The transformation losses, however, are vitally important. In any case these should not exceed, if they should ever be found to equal, the present losses from mechanical friction alone in the many auxiliary steam engines scattered throughout the ship. Losses incident to the transformation of energy vary slightly with the load, but in a different manner for each of the working fluids noted. Again, such losses, if confined to a central-power plant, should not even approach those of similar losses in the transformation of energy in the different power-generating steam engines scattered throughout the ship. The question of the storage of energy is not so important on shipboard as might, on first sight, appear. Compressed air probably admits of the readiest storage for use on naval vessels, with the least disastrous results from shot and shell. A storage battery for electricity or a hydraulic accumulator are practically out of the question. The former requires no system of storage for use on shipboard; the latter almost imperatively requires such storage for maintained distribution of energy.

Looking for a moment at the steam engine required for such a central-power plant, it will be found to be advantageous to subdivide the plant into generating units. Representative types of compound engines now so extensively used for such subdivision are chiefly of the self-contained type. There would be little use for single or paired simple engines for such a central plant.

If steam power is converted into electricity for all of the operations required on board ship, it will be interesting to note different characteristic features of such installation. It would be beyond the range of the present paper to investigate fully the

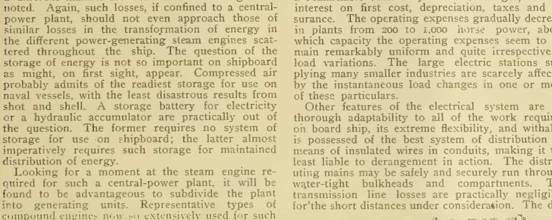


FIG. 1. DIRECT COUPLED SET—MERTZ-ALBOTH COMBINED ENGINE AND DYNAMO

comparative advantages and disadvantages of each of the systems of power distribution—steam, compressed air, water pressure and electricity. The present purpose is merely to have in hand some definite system for a discussion of the steam generating plant required, should all of the power be thus developed in a central plant.

Consider a central power plant made up of compound condensing steam-engine units, each a duplicate of the other, with all parts of the same size and respectively interchangeable, and certain advantages will at once be apparent, namely, the plant may be operated at all times in such a manner that each engine is loaded to its full normal capacity, variation in load may be met by throwing in or out one or more of such steam-engine units. The range of power for variation of load will in no case be imposed on any one engine as in the several steam engines used to drive the scattered auxiliaries.

In the matter of equalizing the load on such a power plant driven by duplicate steam-engine units, it is seen that the conditions are ideal and extremely favorable when applied to electric generation. The plant may be operated at a nearly uniform load day and night, respectively. The electric light load at night may be offset by additional electric-motor load during the activities of the day. Also, certain pumping machinery can be operated at any time by electric motors during the day or the night, so that these may be thrown in or out to compensate for otherwise large variations in load. One in charge of such a central electric-power and lighting plant on board ship would be able to so operate it and obtain a load curve which would be the admiration and envy of central-station managers on shore. Station indicators would so indicate terminal conditions on the circuits that the most efficient operation of the plant would be obtained at all times.

It is quite impossible to treat of this question without further treading upon the debatable ground respecting the merits and demerits of the different methods of power distribution. In all cases, however, the following economic features should be carefully weighed for any given or specified service: Cost of installation, running expenses, involving pay of attendance, cost of coal and water, oil and waste, depreciation and repairs.

In this connection it is important to notice the results of H. A. Foster's analysis of the tests of 22 different power plants.[1] These included manufacturing establishments, electric-light stations, pumping engines, etc. Plants above 200 horse power show a remarkable uniformity in fixed charges, namely, interest on first cost, depreciation, taxes and insurance. The operating expenses gradually decrease in plants from 200 to 1,000 horse power, above which capacity the operating expenses seem to remain remarkably uniform and quite irrespective of load variations. The large electric stations supplying many smaller industries are scarcely affected by the instantaneous load changes in one or more of these particulars.

Other features of the electrical system are its thorough adaptability to all of the work required on board ship, its extreme flexibility, and withal it is possessed of the best system of distribution by means of insulated wires in conduits, making it the least liable to derangement in action. The distributing mains may be safely and securely run through water-tight bulkheads and compartments. The transmission line losses are practically negligible for the short distances under consideration. The distribution losses on the several branch circuits alone require detailed consideration. The direct current is, of course, to be used in all cases. In such a system it is possible to secure a higher maintained efficiency of operation of the plant than any other system, and this is really the point to be desired in any such installation. In the electric system, also, it is possible to control with known certainty distant motors for various auxiliaries, and such control may be from one central point.

The electric system alone admits of such subdivision of the generating plant into equal and interchangeable engine-dynamo units. The advantages of this on shipboard are too apparent to require discussion.

There is not now an auxiliary on board ship which cannot be operated with certainty, efficiency and economy by electric motors. All pumps, fans, blowers, hoists, lifting and steering gear, turret gear and gun mounts may be so operated, and are every day reaching toward this system of operation. The same may be said of the air compressors required for refrigerating purposes.

Boiler-feed pumps can now be far more economically driven by electric motors than by any of the present types of steam-engine cylinders usually attached to the same. They may be set at any time for various rates of feed, and with certainty, from a switch in the boiler room. Air pumps and condensers may be similarly operated, and have their speed and vacuum controlled by a simple switch in the engine room. All low-lift suction pumps, bilge pumps, etc., may be very efficiently operated by either geared or direct-connected, slow-speed electric motors. In fact, the whole of such electric lighting and power-plant installation on board ship may be operated at all times at the most economical and nearly uniform loads, and at uniform steam pressures and speeds for the dynamo engines. This cannot be said of the steam engines operating any other kind of auxiliary machinery or operating any

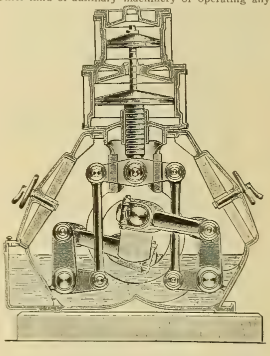


FIG. 2. DIRECT-COUPLED SET.—SECTIONAL VIEW OF ENGINE

other system of power distribution. The inherent advantages of the electric system are chiefly due to the facility of transformation of electrical energy, especially in view of the fact that all such transformations (with or without load variations) in no special manner affect the efficiency and economy of the steam engines driving the electrical generators.

Concerning the effect of variations of load in modern electric-power-plant engines, it is interesting to note that A. G. Pierce and R. S. Hale state of the Boston Edison stations: "As a matter of fact, the steam per indicated horse power in our two 200 units holds within 12 per cent. over a range from one quarter up to full output."[2]

While the above has been noted in the case of large engine-dynamo units, it is none the less true that remarkably uniform rates of steam consumption may be obtained in smaller compound direct-connected units, as has recently been noted in the journal of our society. Two questions are primarily involved in a general consideration of this problem: Economy of installation and efficiency of operation. Respecting the first, it is possible to obtain refinements of design and economic arrangements of installation not yet reached in electric power plant by adopting heat unit specifications and subsequent contract trials upon this basis. At least, the efficiencies, economies, guarantees and contracts now being realized in modern high duty pumping plants should be much more nearly approached in electric power plants. The special features of such heat unit ratings have been presented by the author in two recent papers before the American Society of Mechanical Engineers, from which, Table I. on page 182 has been taken, being compiled from the report of the committee on data of the National Electric Light association, Buffalo, June 8, 1897.

The writer further pointed out in the above paper that some very uneconomical engines have produced remarkable results in point of economy of operation and efficiency of installation. The best of engines may be poorly operated on the one hand, and the whole plant badly arranged on the other.

We enter as strong a plea as anyone for the most economical engine for electric power plants, but we wish to add a further requirement that there should be economic installation and efficient operation to produce the best all round results in the

1. "Variation in the Cost of Steam Power," by H. A. Foster. Transactions of the American Institute of Electrical Engineers, Vol. XIV. Paper presented at the annual convention July 28, 1897.

1. Report of committee on data . . . R. Lew, National Electric Light association, Buffalo, June 8, 1897.

2. "High-speed Self-lubricating Steam Engines," by Alfred Marcum, Journal of the American Society of Naval Engineers, Vol. IX., No. 4, November, 1897.

3. "On Rating Electric Power Plants on the Heat-unit Standard" and "Notes on Rating Electric Power Plants on the Heat-unit Standard" (second paper), by William S. Aldrich. Transactions of the American Society of Mechanical Engineers.

course of a day, a month or a year. Should the government require heat-unit specifications and contract trials for the electric-light and power plants installed on board naval vessels, much better results would be shown than those heretofore attained, of which the performance of the dynamo engines of the U. S. S. Minneapolis, as reported in another paper at this meeting of the society, may be taken as a fair example. In this case there are three duplicate sets of electric-generating units. Each set is driven by a pair of simple engines, 10½ inches diameter, five inch stroke, at speeds ranging from 382 to 425 revolutions per minute, and developing from 17 to 35 indicated horse power under normal working range of loads. Under the best conditions reported (when these engines were tested after several days' run with new pistons and packing rings), the steam consumption ranged from 56 to 88 pounds per indicated horse power per hour. Similar tests have been previous required, it is true, but the contract trial has

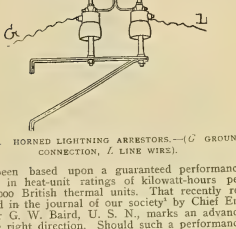


FIG. 1. HORNED LIGHTNING ARRESTORS.—(*G* GROUND CONNECTION, *L* LINE WIRE).

not been based upon a guaranteed performance stated in heat-unit ratings of kilowatt-hours per 1,000,000 British thermal units. That recently reported in the journal of our society[1] by Chief Engineer G. W. Baird, U. S. N., marks an advance in the right direction. Should such a performance of electric-power plants be determined in accordance with and based upon ratings on the B. T. U. standard, it would be of great value for establishing engineering precedent in reference to the power required by the auxiliary machinery driven by electric motors.

As a further example of the values to be obtained when rating the performance of an electric-power plant on the heat-unit standard, Table II. has been prepared.

TABLE II.

Performance of the electric-lighting plant of the Government Hospital for the Insane, at Washington, D. C., based on the heat-unit standard, from results reported by Chief Engineer George W. Baird, U. S. N.

	Small plant.	Large plant.
Date of making test	Nov. 19, 1896.	Dec 1, 1896.
Number of kilowatts per hour	37.20	108 90
Pounds of feed water pumped into the boilers per hour	2,285 00	4,481.50
Mean temperature of feed water, in degrees Fahrenheit	129 9	125 9
Steam pressure in boilers, in pounds per square inch above atmosphere	93.41	92.33
Total heat in one pound of steam, being the heat required to raise one pound of feed water from its temperature to that of the steam at the boiler pressure and evaporate it into steam at that temperature (Kent's tables)	1,085.7	1,089.5
Plant rating—		
(1) Kilowatt hours per 1,000 pounds of feed water	25 03	24.30
(2) Kilowatt hours per 1,000,000 British thermal units supplied to the system	23.06	22.30
Engines, cross-compound, rope-belted to dynamos. Diameters, inches	10½ and 16½	13 and 20½
Stroke, inches	12	12
Indicated horse power developed, when loaded	103.64	197.07

Wherever power is to be transmitted or energy distributed, even for such short distances as occur on board ship, and in varying quantities for many different sized units, the most expensive of all methods is that by the use of steam as the working fluid. While it has been found in many cases desirable, for some purposes, to have a combination or mixed system for distributing power from a central station on board ship, it can scarcely be said to be in accordance with the best engineering practice.

For all operations involving rotary motion, continuous or intermittent, uniform or variable unidirectional or reversible, electricity stands pre-eminently at the head. For certain very definite reciprocating movements with fixed time or distance limits, hydraulic mechanism or electric motor-driven mechanism with hydraulic control, has proven best suited. For reciprocating movements require a cushioning effect, compressed air is better adapted. For efficient service in any case, however, compressed air requires to be reheated and used expansively in a cylinder with all parts and mechanisms practically the same as in the steam engine.

No one system of power transmission can well be

[1] "The Construction, Installation and Performance of the Electric Lighting Plant of the Government Hospital for the Insane, at Washington, D. C." Journal of the American Society of Naval Engineers, Vol IX., No. 2, p. 391.

advocated from a central station until a thorough trial has been made of one system throughout any given ship. This has been pointed out by George W. Dickie, in a recent paper before the American Society of Mechanical Engineers, on "Auxiliary Engines and Transmission of Power on Naval Vessels."[1] Mr. Dickie states: "In the present state of the art of transmitting power to all parts of the modern warship, it is not possible to compare one method with another as a whole, and from actual experience, there being no one ship with a complete system of transmission from a central generating station of one type to compare with another ship having an equally complete system from a central generating station of another type."

There are certain inherent considerations in the use of any working fluid, as well as practical details for its distribution, which set the limits for each of the respective systems. Steam, electricity and compressed air will stand up to the work and permit a considerable overloading of generators and motors. The hydraulic system, on the other hand, is limited and must be installed throughout large enough for the maximum capacity ever likely to be required of it. Again, it is clearly of little avail to transmit power by water or compressed air and have to transform it again into any particular mechanical movement or any required source of energy whenever and wherever such may be required on board ship. Light, heat, ventilation, power for rotary and reciprocating movements, water for sanitation and fire service, and refrigeration are all required to be amply provided for, and such services efficiently maintained on board every naval vessel. That merchantmen have led the way in some instances in the application of electrical distribution for several of the requirements above noted may serve to indicate the possibilities in store for similar central electric-light and power plants to be located on naval vessels. Electricity may, directly or indirectly, provide for all of the above services on shipboard and in an economical manner, with the exception of distributing heat. This, of course, will remain to be supplied by steam distribution or the forced circulation and ventilation of the hot-air system. For quickness and certainty of action as well as almost instantaneous application of the motive power applied, electricity scarcely has a competitor, especially when the power is to be applied in an accumulative manner. An example of this is the recent contract for the operation of the turrets of the battleships Alabama and Illinois by electric motors, following in the wake of the cruiser Brooklyn, similarly fitted out with electric gear.

[1] Transactions of the American Society of Mechanical Engineers, Vol. XIX., No. 761.

Horned Lightning Arresters.

At a recent meeting of the French Society of Civil Engineers, M. V. Langlois mentioned particularly some peculiarities of an installation for the transmission of energy made by Siemens & Halske of Berlin, and Lahmeyer, from which the facts are taken, says that the power station is at Tervueren, while the receiving station is at Brussells. The conductors of this aerial line are three in number and of copper. The tension at the generator, 4,000 volts, is reduced to 120 at the receiving terminal by two tri-phase transformers.

Very thorough precautions have been taken in the installation, not only in perfect construction, but in the highest possible insulation. All the insulators are the triple-petticoat form, of porcelain. The posts supporting the insulators are about eight meters high, and placed at distances of 40 meters. The total loss in the line is about 7.2 per cent. Guard wires, connected to earth, are placed at all crossings to prevent accident in case of a break in the line.

The lightning arresters, called "horned arresters," distributed along the line, are very interesting. They are made up of two copper wires, sufficiently strong, recurved in the same plane, facing one another, in the form of horns, as shown in Fig. 1. These are fixed on porcelain insulators. One of these, G, is in contact with the line—the other, L, leads directly to the earth.

If the lightning strikes the wire it finds a path to the earth by crossing the minute film of air between the horns. An arc is at once formed at this point; the heat makes an upward current in the air, which rises until the arc is broken—blown out. Fig. 2 represents the appearance of such an arc, resulting from a short-circuiting of 10,000 volts.

One of these arresters is placed on each of the three wires at the entrance of each terminal station and at three intermediate points on the line. In addition to these arresters, each wire is furnished with a cut-out, composed of fine copper wires in glass tubes filled with gypsum. An overplus of current in the primary fuses these wires and opens the circuit.

TABLE I.

Showing examples of rating electric power plants on the heat-unit standard, reduced from 1897 report of committee on data of National Electric Light association.

Station No. in 1897 Report N. E. L. A.	Pounds feed water per kilowatt-hour at best efficiency.	Temperature of feed water, Fahrenheit.	Steam pressure above atmosphere, pounds per square inch.	Total heat B. T. U. in feed water per pound.	Plant Ratings. Kilowatt-hours per 1,000 lbs. feed water, gross efficiency.	Kilowatt-hours per 1,000,000 B. T. U. at best efficiency.	Type of engines.	Rating at best efficiency, water per I. H. P. hour.	Method of driving dynamos.	Dynamos daily output. Watt-hours.	Kind of service daily.
1	2	3	4	5	6	7	8	9	10	11	12
4	23 50	.....	160	.....	42.60	.....	Vertical triple expansion, four-valve.	15.0	Direct-connected.	200,000,000	Incandescent, 24 hours.
14	26 65	120	115	1,100 00	37.55	34.14	Tandem, compound condensing. Double tandem, compound non-condensing. Cross-compound.	17.5	Belted to jack shaft. To dynamos.	124,000,000	Arc and incandescent, 24 hours.
1	37.50	212	125	1,009.50	26.70	26.45	Vertical compound, non-condensing, four-valve.	25 8	Direct-connected.	13,600,000	Incandescent, 24 hours.
10	38.10	.....	112	.....	26.30	.....	Compound condensing Simple non-condensing.	28.3	Belted to dynamos.	3,400,000	Arc and incandescent, 24 hours.
2	39.30	212	125	1,009.50	25.50	25.26	Horizontal cross-compound condensing. High speed, single-valve, automatic.	25.7	Belted to dynamos.	1,400,000	Incandescent, 6 to 12 hours.
7	45.00	180	135	1,053.20	22 20	21.08	Simple non-condensing. Compound non-condensing.	28 0	Belted to dynamos.	13,000,000	Incandescent, 24 hours.
8	45.00	.....	160	.....	22.20	.....	Cross-compound condensing. Tandem compound.	28.0	Direct-connected. Belted to dynamos.	12,400,000	Arc and incandescent, average 17 hrs.
5	47.70	208	125	1,013.50	21 00	20 72	Simple non-condensing. Compound non-condensing.	29.1	Belted to dynamos.	15,600,000	Arc and incandescent, 24 hours.
9	53.27	140	120	1,080.70	18.80	17.39	Single-acting compound condensing. Simple automatic non-condensing.	28.0	Belted to dynamos.	2,700,000	Arc and incandescent, 24 hours.

Philadelphia Electrical Exhibition.

The Philadelphia Electrical Exposition company will give an electrical exhibition in its building 818 and 820 Chestnut street, beginning June 6th, and continuing for one month. There has been no exhibition given in that city since 1884, and it is believed public interest will be aroused by a systematized attempt to show the progress of elec-

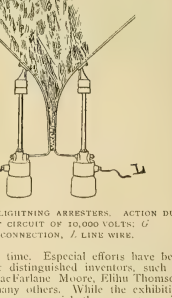


FIG. 2. HORNED LIGHTNING ARRESTERS. ACTION DURING A SHORT CIRCUIT OF 10,000 VOLTS; *G* GROUND CONNECTION, *L* LINE WIRE.

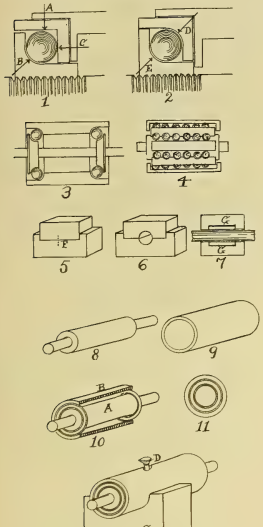
tricity since that time. Especial efforts have been made to interest distinguished inventors, such as Edison, Tesla, MacFarlane Moore, Elihu Thomson, Steinmetz and many others. While the exhibition will necessarily be commercial, the promoters give assurance that no pains will be spared to make it of the highest scientific character. Much thought and time will be given to tasteful decorations, and good music will be a feature. The management has obtained the services of Prof. William D. Marks as director. His former experience as manager of the Franklin Institute exhibition and his intimate knowledge of the advances in electricity qualify him for this new responsibility.

Bearings in Electrical Machinery.

By B. F. Fells.

Owing to the high speed at which most electrical machinery is run, the bearings are a potent factor. Forms of ball bearings are useful to builders of certain kinds of electrical apparatus. Again, we find types of aluminum and even glass-bushed bearings. In one style of ball bearings there are but four balls on each cone, and these are kept in position by a ring, which is provided with a socket for each ball. The cone is held to the shaft with a key. A variety of forms for cones and ball-retaining casings is in use. The pattern in Fig. 1 is a three-point bearing, the ball contacting with the cone at B and the case at A and C. It is a good form of bearing and useful in many places on electrical machinery journals, providing that the balls, cones and cups are absolutely true, smooth and non-elastic. Each ball should be tested and found strong enough to carry alone all the weight which may be put on the bearing, because it is at times called upon to take practically all of the load for an instant.

Some builders of electrical machinery use the two-



BEARINGS IN ELECTRICAL MACHINERY.

point bearing, shown in Fig. 2, in which the ball contacts with the cone at E and with the case or cup at D. In some of the first patterns of ball bearings a flat rolling surface was provided for the balls. It was found that the balls were free to become displaced laterally, and to overcome this the surfaces of the cone and cup are now made concave, as shown. In another style the balls are linked by a shaft and kept in place by the casing. One might suppose that the balls would groove the shaft. The arrangement results in a two-point contact for the top series of balls and a three-point contact for the lower, as the latter touch the lip on the casing.

The pattern in Fig. 3 is fitted with cones of large diameter, and is applicable for high speed.

Roller and Ball Bearings.

In the combination roller and ball-bearing design in Fig. 4, it is apparent that the adjacent surfaces of the balls and rolls rotate in opposite directions, yet there is practically no friction between them, because there is no positive pressure of one against the other. This kind is used for bearings which must run very steady.

Wood Bearings.

There are times, when it is necessary to make a bearing of wood. Select good, clear stock and cut out the body pieces and start a guide for the auger by sawing into the top and bottom, straight across, as at F, Fig. 5. Then bore for the shaft, as in Fig. 6. Fig. 7 shows a section with the stock cut out at G G, into which space some bushing may be placed. Bore a hole at each corner for the bolts.

Process of Making Aluminum Bearings.

A good alloy from which to make bearing sleeves for electrical machinery is made as follows:

Aluminum	94.10
Antimony	4.01
Tin	0.88
Copper	1.01
Total	100.00

The tensile strength of sleeves made from this alloy is 24,000 pounds.

Glass Bearings.

Traulinie gives the tensile strength of glass at from 2,500 to 9,000 pounds per square inch, according to variety; crushing strength, 6,000 to 10,000 pounds per square inch. Transversely, flooring glass, one inch square and one foot between the end supports, breaks under a certain load of about 170 pounds. The glass is bought at glassworks and molded into bushings for journals. It has been used with some success on light work.

Making Bearings and Journals.

To cast sleeves for journals, secure a mandrel (Fig. 8) of the same size as the shaft and steel. Fit over this a steel case (Fig. 9). The sectional view in Fig. 10 shows the case B on the mandrel with the collars (a a) between. A cross-section is given in Fig. 11. The device, set up and ready for pouring, is shown in Fig. 12. The anvil is marked C and the pouring funnel D. In order to compensate for contraction a piece of paper may be wrapped around the shaft and wound with a thread. Clean away dirt, oil, etc., before pouring. It is a good plan to warm the mandrel before pouring; this will prevent chilling and blocking up the passage.

Trueness of Bearings.

Electrical machinery bearings must be perfectly true to avoid heating from the high speed often required. The tendency is for some bearings to contract at point E, Fig 13. Others fail to adjust correctly, as at F, Fig. 14. Again, the sleeves do not join, as shown at G, Fig. 15. Turning out on the lathe and sometimes filing will remedy the evils.

For testing the friction of a bearing which is supposed to be untrue, fix a small grooved pulley to the shaft of the bearing. A cord is then wound about the pulley and run down a scale. The bottom of the latter should bear weights. Whatever weight is required to start the bearing to turning and keep it going will be recorded on the scale, and the proportion of friction, etc., may be determined by the use of the tables given in engineering books.

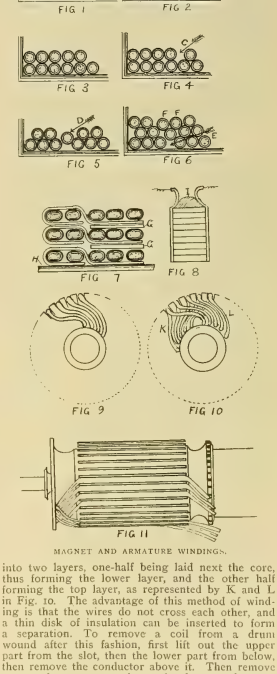
Magnet and Armature Windings.

A contributor of the Western Electrician, who sends the accompanying drawing, notes a difficulty which always presents itself when winding magnet coils and which is shown at A (Fig. 1). The wire is wound on the plan of a screw thread, necessarily, and the space for the last round is narrowed down too much for the coil to fit. There are many men who make a business of winding magnet coils who overcome this trouble by forcing the last turn down, crowding the coils, and oftentimes injuring the yielding insulation to such a degree that its efficiency is affected. This is carried to such an extent at times that the insulation is badly cut between the wedge-like edges. On the other hand, if the last coil is not pressed down into place and the second layer is wound, as in Fig. 2, a space will exist at B. These places form the base of that evil known as spreading. As is known, the least spread of the wires in the lower layer produces serious undulations in the successive layers, for the depression in the layers increase towards the surface. If the coils are wound as in Fig. 3, one layer topping the other, winding right-hand for first layer and left-hand for second layer, it is found that the last layer is gaining on the first, with the result that one is obliged to allow the wire to drop over between the wires ahead, thus leaving a space at C (Fig. 4).

The consequence of continuing to wind after the misplacement of one or more coils is illustrated in Figs. 5 and 6. If a second-layer wire takes the position shown at D (Fig. 5), and winding is continued over this, we get something after the plan in Fig. 6, in which E shows the space left in the first layer and F F the two wires of the third layer sunk below the proper level, owing to the dropping of the wire of the second layer into the space E. Two ways are employed to overcome these troubles. One is the result of long practice with winding magnet coils, which qualifies one to calculate closely on the required compactness of the layers to keep each even. The other method calls for figure work. The size of wire to be used is calculated, the insulation allowed for, and the number of turns per layer ascertained. Then the same number of turns is put into each layer. The first layer is carefully placed and is used for a guide for the succeeding layers. Take a coil six inches long, for example, and wind it with No. 20 wire, the gauge of which is increased about .004 of an inch by the insulation. A little calculation would show that the bare wire would fill the space with, say, 200 turns. The insulated wire would fill it with about 146 turns. With the coarser wires, No. 12, for instance, 60 turns of bare wire might be sufficient to fill the space, and about 44 turns of insulated.

Fig. 7 shows the method of winding a "short" ring armature. The core insulation is marked H and the cotton cloth G. The latter is wound as the work is progressed, and prevents the outside wires from getting out of position during the building of the bobbin. Three systems of winding are employed. These are selected according to the work required. The first system is made with 13 turns of the bobbin, and possesses the most torque. The second is made with nine turns and has high speed. The third is made with 12 turns and is the medium range. The armature slots are insulated with fullerboard and mica. The method of securing the wire is shown in Fig. 8, in which I indicates a section of a curved piece of wood, which is sustained between the lips of the projection.

In Fig. 9 is shown a good way to wind a drum armature. This end view indicates how the connectors may be passed from slot to slot, divided



MAGNET AND ARMATURE WINDINGS.

into two layers, one-half being laid next the core, thus forming the lower layer, and the other half forming the top layer, as represented by K and L in Fig. 10. The advantage of this method of winding is that the wires do not cross each other, and a thin disk of insulation can be inserted to form a separation. To remove a coil from a drum wound after this fashion, first lift out the upper part from the slot, then the lower part from below, then remove the conductor above it. Then remove every other upper conductor in the span between the two slots and then the coil can be removed, and if damaged, replaced with a new one.

Fig. 11 shows the method of a packed "straight-out" winding, which is constructed with the coil protruding. The coils form a cylindrical ring at the end of the armature, where they are protected by tape wound on the ring. A metal support is provided for the ring, and this ring is so shaped as to form a part of the disk end which holds the laminæ and armature in place.

The receiver for the Metropolitan elevated railroad of Chicago has asked Judge Showalter for permission to equip eight additional motor cars for use on the three branches. The cost will be $13,000. The additional motors will decrease the minimum headway on the branches to six minutes and on the loop to a minute and a half.

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June 12, 1897	80	100	8,843

No other electrical journal has ever equaled this record of 8,843 square inches of genuine full-paid advertising in a single issue.

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An English writer makes a curious complaint in relation to an American technical magazine. "This is a good number," he writes, "but, as usual, one cannot open it in a rain-shower, however slight, for fear of gluing the pages together." The critic may be very zealous in the pursuit of knowledge, but the ordinary mortal does not stand unprotected in a storm to do his reading.

Electrical men should look to their laurels. In the patent report for March 15th there was a scarcity of electrical patents such as has not been noticed in many years. Heretofore it has been customary to regard the patent issues as an indication of the condition of the electrical industry, but at the present time all indications disagree with the patent department, as there seems to be no reason for the dearth of invention disclosed by this record.

There seems to be no doubt that the overhead trolley will soon be admitted to the downtown business district in the South Side system, as the Chicago City Railway company and Mayor Harrison have reached an agreement for the construction of temporary lines on State street and Wabash avenue. It now remains to be seen whether the people, after experiencing the good results of the electric system, will consent to the retention of the cable in the South Side service.

According to the daily papers a Polish schoolmaster has solved the problem of transmitting photographs electrically, but the latest European exchanges discredit the statements cabled from London and Vienna. It will be necessary, in any event, to await the pleasure of the inventor, as he declines to give any particulars or disclose the methods he employs any more than in the most general terms. The subject is of great interest, however, and information from authoritative sources will be eagerly awaited.

M. Branley has recently shown to the Society of Electricians of Paris some results of experiments in the line of signaling telegraphically without wires. He placed in circuit a tube filled with iron filings, a battery and a galvanometer. In a normal condition the tube offered a very high resistance, but if some producer of electric waves was put in action the conductivity of the tube was rapidly augmented. It was shown that this tube could be made available as a receiver of electric vibrations having their origin at a distance.

At a recent meeting of the International Electrical Society, says the Revue Générale des Sciences, M. Bucherot gave some results of his experiments with industrial condensers. He found that paraffined paper gave excellent results, but the condenser should not be allowed to heat, as its insulation resistance would fall rapidly with a rise of the mercury. A paraffined paper condenser showed an insulation of 2.6 megohms at 37° C., but fell to 700,000 ohms at 50°, and to 100,000 at 80°. A difference of potential of over 800 volts is liable to pierce the insulating paper.

Novelty in conventions of such organizations as the Northwestern Electrical association is not always attainable without sacrificing some valuable features, but it is promised that the plan adopted for this summer's meeting of the Northwestern association will accomplish this purpose. There can be no question as to the novelty and charm of the plan proposed, and it is believed by the promoters that it will ensure the most interesting and successful gathering in the history of the organization. It is an ambitious undertaking, to be sure, and its successful accomplishment can only be brought about by persistent work and unanimous support on the part of the members and friends of the organization. With this fact impressed upon them, it remains only for the promoters to put forth their best efforts and present an attractive programme. The lake trip itself will doubtless be an enjoyable event, and as the points at which it is proposed to stop between Chicago and Duluth are fraught with interest to electrical men, all branches of the industry should have large representations. The cities of Duluth and Superior have extended very cordial invitations to the association, and the representative bodies of those communities are already preparing to make the event noteworthy in the annals of the Northwestern Electrical association and the history of those municipalities.

A correspondent who has just completed a report of an investigation of a municipal lighting plant makes a request that will provoke a smile from those who have had experience with similar undertakings:

> You are perfectly welcome to tear it [the report] to pieces if you do it in a decent way, remembering when doing so that I am not an especial advocate of municipal ownership and also omitting the stale arguments about politics, because there are none in this case.

It is really refreshing to find such trustfulness. Our correspondent evidently does not appreciate the fact that it is politics that the honest advocates of municipal ownership fear, and that a desire for political influence and power for corruption alone influences those who are not actuated by honest motives. The city plant upon which he has made report may not have suffered from the manipulations of local politicians, but the indications are that it did, and that had it not been for their work his services would not have been in demand. However, as the conditions are not all clearly set forth it is scarcely worth while giving the matter further consideration.

Not only do the dictates of common humanity and good business judgment impel street-railway companies to use the best attainable braking and controlling apparatus, but the decisions of the courts show that such a course is imperative as a prudential measure. An instructive case in point is that of Thompson against the Salt Lake Rapid Transit company, which was recently reviewed by the Supreme Court of Utah. The circumstances of this suit are well adapted to point a moral.

It appears that at the time of the accident the motorman saw a well-grown, deaf-and-dumb boy 14 years of age approaching the track, with an evident intention to cross, without seeing the car. The motorman applied the brakes, but they were so defective that they did not work, and he (the motorman) received a shock from the defective apparatus that delayed his purpose for a second. Therefore he could not stop the car until the injury was done, because of the defective brakes. The car ran 50 feet after striking the boy. The company had had repeated notice of the defective brakes and motor, but failed to repair them, and it was shown that if the car had been in repair it could have been stopped within eight feet.

Under these circumstances the court held that the company was negligent in the use of the car. If the company knowingly placed in operation upon the public street a defective car that could not be controlled because the appliances provided for that purpose were out of repair, and the injury complained of was occasioned by such defective brakes and appliances, and the motorman was unable to avoid the effect of the contributory negligence of the boy, because of such defects, then, declares the court, it could properly be said that the company's negligence was the proximate cause of the injury. To this it adds that the company should not be allowed to excuse its own want of reasonable care, and avoid liability, by showing that, prior to and at the time of the accident, it had knowingly been negligent in keeping its car and appliances in order and repair, and that on account of such negligence it was unable to prevent the injury complained of at the time by the use of ordinary care.

The court pointed out that when the company placed its cars upon the track for service a person attempting to cross the track in front of one of them had a right to expect that the usual appliances for starting, stopping and controlling the car were provided. Knowingly placing an electric car upon a track in a public street, and allowing it to run without such appliances for its control, the court holds, is not only gross negligence, but it may amount to criminal negligence in case of injury to one without his fault. When both parties are negligent, the true rule is said to be that the party who last has a clear opportunity to avoid the accident, notwithstanding the negligence of his opponent, is considered solely responsible for it.

Northwestern Electrical Association.

A meeting of the committee of the Northwestern Electrical association was held at Janesville, Wis., on March 14th, to consider the question of holding a midsummer convention. Pliny Norcross, P. H. Korst, Henry L. Doherty and J. M. Hill were present, James R. Dee of Houghton, Mich., being the only absent member. The following resolution was unanimously adopted:

Resolved, That as a committee of the Northwestern Electrical association, we accept the invitation of the cities of Duluth and Superior to visit those cities next June, and that J. M. Hill of Chicago be authorized by this committee to make arrangements with any steamboat company for a summer meeting of said association. to be held en route from Chicago, via Sault Ste. Marie, Hancock and Houghton, to Duluth.

The plan proposed involves a trip by steamer from Chicago to Duluth and Superior, returning by rail. It is probable the Manitou will be secured for the event. The time consumed by such a trip, including two days' convention at Duluth and Superior, would be between five and six days. It is proposed to hold this convention immediately following the meeting of the National Electric Light association at Chicago on June 7th, 8th and 9th, and it is hoped that many members of the latter body will take advantage of the opportunity to make a lake trip between Chicago and Duluth. The plans provide for leaving Chicago not later than Saturday, June 11th, and with this arrangement Mackinac Island would be reached early Sunday morning and Sault Ste. Marie shortly after noon. One feature of the programme is a four-hour stop at this place to enable the visitors to inspect the ship canal and other points of interest on the American and Canadian sides. The party will leave Sault Ste. Marie Sunday night, arriving at Hancock Monday morning. A visit to the mines of the Calumet and Hecla Mining company has been arranged. The ladies of the party will remain at Hancock and Houghton, where entertainment will be provided. An early start will be made from Hancock Monday afternoon in order to reach Duluth Monday night.

The expense of the entire trip, including steamer, meals, state rooms, hotels at Duluth and Superior, railroad fare returning, including sleeping-car accommodations and dining car, will not exceed $43, according to the committee's estimate, which is based on direct proposals made by the steamship company and reduced rates of $2, $2.50 and $3 per day promised by the hotels at Duluth and Superior. One-third rate by rail returning from Duluth to Chicago has been secured from the Western Passenger association.

It has been suggested that Frederick N. Bosson, chief electrician of the Calumet and Hecla Mining company, be invited to read a paper on the subject of "Reduction of Ores by Electricity." Such a contribution would be an attractive feature, especially in view of the visit of the association to the copper country and Mr. Bosson's eminent position in electrolytic work.

President Copeland has appointed J. M. Hill, W. W. Low and F. E. Donohoe of Chicago a committee of arrangements for the entertainment of the delegates.

Electric-light Trimmers Not Public Officers.

A person employed by a city council to trim lights in its electric-light department, the Supreme Court of Ohio holds, in the recent case of the State against Anderson, 49 Northeastern Reporter, 406, is not a public officer. Neither is an engineer employed to run an engine in such department. The explanation of this is found in the case of the State against Jennings, decided at the same time, where the court says that to constitute a public office, against the incumbent of which will lie what is termed a writ of quo warranto, to test his right to hold such office, it is essential that certain public duties, a part of the sovereignty of the state should be appointed to it by law, to be exercised by the incumbent in virtue of his election or appointment to the office thus created and defined, and not as a mere employe, subject to the direction and control of someone else. The practical application made of this doctrine was to base on it a refusal of the writ of quo warranto sought for the purpose of ousting certain trimmers and an engineer from their employments.

Pontiac-Flint Electric Railway.

A company has been organized to build an electric railway 40 miles long to connect the cities of Pontiac and Flint, in Michigan. George E. Taylor of Flint and J. E. Sawyer and Hon. S. W. Smith of Pontiac are interested in the enterprise. The road will pass through a well cultivated, fertile and prosperous section of the state, the route surveyed touching the villages of Drayton Plains, Waterford, Clarkston, Ortonville, Goodrich, Atlas and Grand Blanc. Some of these places are not on any steam railroad line, and a good passenger and freight business is anticipated for the new road. The track will be laid with 70 pound steel T rails, and it is expected that grading will be begun in a few weeks. A power house at either end of the line is contemplated, but the engineering plans appear to be still incomplete. Mr. J. E. Sawyer of Pontiac can give more detailed information about the project.

Toronto Magnetic Observatory.[1]

By R. F. Stupart.

The importance of obtaining a correct knowledge of the elementary facts of terrestrial magnetism, for the purpose of supplying a foundation whereon the advancement of that science on inductive principles may be based, has for long been strongly and extensively felt.

From an early period of the meetings of the British Association for the Advancement of Science, the interest of terrrestrial magnetism had received no inconsiderable share of the attention and exertions of its members. In the year 1834 a magnetic survey of the British Isles was commenced and carried through in the two following years by the joint labors of five of its members. In 1835 the association called for a report from one of its members, on the state and progress of researches regarding the geographical distribution of the magnetic forces on the surface of the globe, proposing to ground on the preliminary examination an application to the government to aid in the prosecution of the inquiry in remote parts of the earth, unattainable by the means at the command of the association itself, or of its individual members. This report, presented in 1837, was taken into consideration at the meeting of the association, at Newcastle, in 1838, and a memorial was addressed to the government which, being favorably received by her majesty's ministers, originated the naval expedition equipped in the following year for a magnetic survey of the high latitudes of the southern hemisphere. Deeming the opportunity a fitting one, the British Association availed itself of the same occasion to solicit the attention of her majesty's government to the expediency of extending the researches to be accomplished by fixed observatories to certain stations of prominent magnetic interest within the limits of the British colonial dominions. The stations named were Canada and Van Diemen's Island, as approximate to the points of the greatest intensity of the magnetic force in the northern and southern hemispheres; St. Helena, as approximate to the point of least intensity on the globe, and the Cape of Good Hope as a station where the secular changes of the magnetic elements presented features of peculiar interest.

The committee recommended that the proposed colonial establishments should be placed under the general supervision of the Ordance Department of the army. The government having expressed a desire that such extensive arrangement involving a considerable expenditure should be strengthened by the concurrent support of the Royal Society, a deputation was appointed to express the cordial participation of that society in the recommendation both of the naval expedition and of the fixed observatories. Arrangements having been completed, Lieutenant Charles James Buchanan Riddell, R.A., was selected for duty in Canada, who, leaving his detachment, consisting of four non-commissioned officers of the artillery, to embark with the instruments on a vessel bound direct to Quebec, proceeded himself to Canada by the more expeditious route of the United States, and having waited on the governor-general at Montreal to present a letter of introduction with which he had been furnished by the master-general of the ordnance, and communicated with the commanding engineer, to whom he was the bearer of instructions and authority to build an observatory, he proceeded to examine different localities which were suggested as convenient sites. The preference was finally given to Toronto, where a grant of $2\frac{1}{2}$ acres of land belonging to the University of King's College was offered by the council of the University. The first observatory building was of logs, rough-cast on the outside and plastered on the inside; it was completed during the summer of 1840 and observations were begun in September. The operations of the observatory as an imperial establishment were brought to a close in the early part of the year 1853, and were resumed under the authority of the provincial government in July of the same year.

In the autumn of 1853 the present observatory was commenced, to take the place of the old building. Very great care was taken during construction to insure all the stone used being entirely free from magnetism, and all nails and fastenings were of either copper or zinc. For 23 years the position of the observatory was, as far as is known, faultless, and observations were carried on systematically and carefully, and results given to the scientific world, which, with those obtained under the old military regime, have made the Toronto Observatory famous in the history of terrestrial magnetism.

In 1876, however, trouble began with the building of the School of Science, which institution, however, being principally of brick and wood, caused but very small changes in zero values, which could be allowed for. Then followed, a few years later, electric light circuits which produced a change in the force instruments whenever the current was turned off or on; this difficulty was in part overcome by the light company courteously agreeing to arrange its wires in the vicinity of the observatory in such a manner that currents should counteract each other. The next difficulty occurred when the addition was given to the School of Science, tons of iron being used in the construction of that building in an all too-close proximity to the magnetic instruments, and much time and labor have been required to determine the precise effect of this "iron mine" on the various instruments. It was not, however, until the autumn of 1892, when the trolleys began to run, that we began to suspect that sooner or later the Magnetic Observatory would have to be removed to another site.

The magnetic instruments in the observatory consist of those brought out by Lieut. Riddell in 1840, of which eye readings have been taken six times each day, and of another set of similar instruments, consisting of a bifilar, for the measurement of the horizontal component, a balance needle for the vertical force and a declinometer, all of which record photographically.

Electric cars first ran in Toronto on August 17, 1892; the line first put in operation was that on Church street, which was followed on September 5th by King street, between George street and Dufferin street. During the first few weeks, while a very small vibration of the needle was discernible on the v. f. curve, it was generally almost inappreciable, and it was not until September 20th that the movement increased to an extent sufficient to really impair the value of our magnetic curves; a marked increase of current must have been used on that day and afterward. On October 10th the cars first ran on Yonge street, and there was only a very small increase in vibration, but a decrease of about .000070 of a dyne was observed when the current was on. About 10 a. m., on January 14th, there was a marked increase of vibration, and the vertical force increased about .000200 one dyne. This disturbed period was only temporary, and shortly after 5 p. m. of the 17th there was a reversion to the smaller vibrations, which continued until May 15th, when very large vibrations began again and continued with varying intensity during the summer, while the decrease of the v. f. with the current ranged from about .000200 to .000500. This disturbance was very great between September 12th and October 17th and at intervals during the following year, but there was no radical change in conditions until December 17, 1894, when a decrease of v. f. while the current was on was changed to an increase, this occurring when the cars first ran on McCaul street. Throughout 1895 the vibration and amount of permanent deflection were very nearly as they have been since, but on October 15th the increase of v. f. with the current was again changed to a decrease. This occurred at the time that the railway company made certain changes in the feed wires. It is noticeable that, although several changes occurred in the v. f., it at times has been less with the current on and at other times greater. The horizontal force showed a steady decrease on all occasions with the turn on of the current, which during the past two years has been .000200 to .000500. No appreciable deflection of the declinometer magnet can be noted, the only effect being a continuous vibration which has rendered the curves very ragged and difficult to read with accuracy.

A study of the traces during the times that the various electric lines were put in operation shows that with the currents ordinarily used there is little effect at three fourths mile, and a further survey with a portable instrument affords further evidence in the same direction; it has, therefore, been determined to remove the magnetic instruments to a point distant two miles from any probable trolley route and about nine miles from the present location, and continue what is certainly the most valuable and extended magnetic records outside of Europe.

1 From the Canadian Engineer.
2 The history of the establishment of the observatory at Toronto is taken from the early report.

The Trolley Wins in Chicago.

It is admitted that the Chicago City Railway company won a notable victory on Monday when negotiations were practically closed between the city and the company by which the latter will be able to bring its trolley cars downtown during the progress of the track-elevation work at Sixteenth and Clark streets.

The company secures its permit for trolley poles and wires in Wabash avenue and State street from Twenty second to Van Buren street. From Van Buren street north to Lake street, the northern terminus sought by the company, the route will be circuitous, the State street electric cars following Van Buren to Wabash avenue, Wabash avenue to Madison, Madison to Michigan avenue, Michigan avenue, to Randolph, Randolph to Wabash avenue and thence south in Wabash avenue to Van Buren, where they will return to State street. This scheme keeps the trolley under the elevated loop structure in the downtown district, except for two blocks in Michigan avenue and two in Madison street. The company already has permission to use the streets under the Union elevated loop structure, by virtue of an ordinance apporved by Mayor Swift. The mayor agreed to issue a permit on condition that the company enter into an iron clad written agreement to remove the poles and wires at the direction of the mayor, not to ask for an injunction restraining the city removing them at any time, and also not to ask the council for an ordinance to retain the poles and wires during the time they are standing.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from Iowa.

[Special correspondence of the Western Electrician.]

Waverly, March 21.—The Cedar Valley company is about to build a line from Allison to Hampton. Farmers in Emmet County contemplate building a line to connect several farms with Armstrong.

The Standard Telephone company of Waukon will extend its lines to all points in Winnesheik County, and also to Elkader via Farmersburg and McGregor.

The C. R. & M. Telephone company will extend its system to Marshalltown. It is now trying to establish an exchange at Marion.

The Mississippi Valley Telephone company contemplates building a line to Dubuque via Savannah, Ill.

The Western Electric Telephone company, of which J. F. Cass is president, will construct at least 500 miles of new toll lines and several exchanges, principally in Minnesota. This company is doing extensive work in Kansas and Missouri. The Interstate Telephone company, with no definite headquarters at present, expects to build extensively in Southern Iowa and Nebraska.

The Des Moines telephone exchange is gaining daily in subscribers. The same is true at Marshalltown and Cedar Rapids. Reports indicate that at all points the Bell company is falling behind.

E. T. Keim is building an exchange at Centerville.

An opposition exchange will be built at Muscatine and, if a franchise can be obtained, at Davenport and Dubuque. Ample capital is back of this movement.

The Iowa Telephone company will build a line from Guttenberg to Dubuque. It is the intention of this company to have every county seat in Iowa connected by its long-distance system soon. It will also extend its lines via Belle Plaine to Marshalltown, build two circuits from Dubuque to Sioux City and connect with the Northwestern Telephone Exchange company at Austin and Prosper, Minn. Connections with the Wisconsin Telephone company's lines are contemplated at Boscobel, the Iowa company building from Prairie du Chien. Extensions will be made from Northwood.

Several changes have been made and others are now contemplated in the staff of the Iowa Telephone company, which is, of course, a Bell concern. J. R. Lane, who has been president of the company, will be succeeded by C. E. Yost of Omaha, Neb. T. von Rolf, assistant superintendent, has resigned. to take effect April 1st. He has served the company for the last 16 years. C. R. Wood has been placed in charge of West Union and Decorah. and A. Hooper has been placed in charge of McGregor, Waukon and Prairie du Chien. F. H.

Telephone Regulation Rejected in Kentucky.

A telephone bill was proposed in the Kentucky Legislature, which has just completed its deliberations, by the Owensboro Harrison Telephone company and was supported by the independent companies throughout the state, but it failed, greatly disappointing all classes of people throughout the state. A dispatch from Frankfort in the Daily Owensboro Messenger thus explains the defeat of the measure:

> The telephone bill requiring uniform charges for telephones in cities of the same class, which passed the Senate ten days. ago, failed to get through the House The efforts to pass this bill were fiercely resisted by the powerful Bell telephone lobby, but only the name of Joe Blackburn finally defeated it. A clear majority favored it, but the rules committee, aided by Speaker Beckham, refused to let it come up on account of Blackburn, who was employed by the Bell company to come here and make a speech before the committee against the bill.
>
> Notwithstanding Blackburn's speech, both the Senate and House committees unanimously reported in favor of the passage of the bill and it passed the Senate unanimously, but was blocked in the House.
>
> The main argument against the bill was that Blackburn was to get [illegible] fee in the event of failure of the bill, and his friends in the House wanted him to earn the money

This announcement has stirred the wrath of other Kentucky gentlemen, and, as a result, Senator Blackburn has been roundly denounced for his part in the proceedings. Here is a sample of editorial denunciation from the Daily Inquirer of Owensboro:

> A measure of the Kentucky Legislature is given in the report of the fate of the telephone bill the object of which was to cause telephone companies to [illegible] a uniform tariff in cities of the same class. Both committees reported unanimously in its favor and there seemed to be no doubt of its passage until it was learned that Joe Blackburn had been employed to lobby against it and was to receive [illegible] in the event of its defeat. Then the table turned and the bill was lost. We are told by an eminent [illegible] authority that "the main argument against the bill was that Blackburn was to get a fee of [illegible] in the event of the failure of the bill and his friends in the house wanted him to earn the money." [illegible] to any one of contempt too severe for an action like this. [illegible] the common or dinary, everyday kind [illegible]

Evart Telephone Exchange.

The Evart, Mich., telephone exchange was started in 1896 with nine [illegible] on a grounded system. The number has [illegible] to 33, the limit of the present board, but negotiations are now pending for the installation of a 100-drop board, with a fair prospect that a large portion of it will be taken up the coming season. The system has been changed to common return and when the new board is put in another change will be made to complete metallic circuits. The Citizens' Mutual Telephone company of Grand Rapids, Mich., connected its lines to the Evart exchange a year ago, and the subscribers of the Evart exchange consequently connect with 130 different towns in Michigan over the Grand Rapids system.

Telephone Extension in Chicago.

It is taken as a gratifying evidence of the return of business confidence that on March 10th the number of calls answered in the exchange of the Chicago Telephone company reached the number of 226,221. This is believed to be the largest number of messages handled in any exchange in the world in one day. New York has touched 190,000, and it is not thought that any of the foreign exchanges have reached that figure. General Manager Hibbard states, too, that while the number given for March 10th is the highest recorded, it is not very far from expressing the daily average of messages handled at the present time. It is interesting, for the purpose of comparison, to note that on March 10, 1897, the calls answered were 189,993. The 226,221 calls of March 10th last figure out an average of 18 calls for each telephone connected with the main office and branches of the company. However, if the residence telephones were excluded from the computation the average would be much higher.

Work is under way on the two new down-town branch exchanges of the Chicago Telephone company in the Title and Trust (Washington street) and Manhattan (Dearborn street) buildings, but it will be a month or so before they are ready for use. Land has been purchased for a new telephone building for the company on the West Side, near Madison and Peoria streets. The structure will be devoted to the West Side exchange and will be built this year.

Telephone Situation in Elkhart.

The independent telephone interests in Elkhart and throughout Indiana are actively engaged in extending the system in that section. The Elkhart company recently printed its list of subscribers in a daily newspaper and requested the Bell company to follow its example. Some interesting statements are presented in the announcement of the local concern:

> Three years ago there were in Elkhart 100 telephones at an average rate of $42 per year or 42 cents for every possible connection.
>
> The home company, now two and one half years old, has 355 subscribers at an average rate of $21, or a trifle less than six cents per year for every possible connection. All this in the face of nominal rates and free service competition, thanks to the loyalty and fidelity of our friends and neighbors.
>
> A similar growth and revolution is visible over the entire state. The people now have 137 exchanges against 27 by the old company, 1,500 toll points against 307 by the old. The home companies own 4,600 miles of toll lines and fully 20,000 telephones in Indiana alone. and we are not aware of one financial failure among them. Some adjoining states make even a better showing.

The obnoxious features of the Bell policy are attributed by the Elkhart company to the influence of the parent company. "The general policy of defiance emanates from Boston and not from Chicago or Indianapolis," it says.

European Telephone Statistics.

Some interesting statistics have been compiled showing the number of telephones in use in several European countries. The returns from Norway, Denmark, Finland, Great Britain and Portugal are incomplete. Turkey and Greece have no telephone systems. In the list of nations thus far reported Germany occupies a commanding position. Following is the data thus far gathered:

Country.	No. of exchanges.	No. of instruments.	Ratio of instruments to population.
Germany	534	131,577	1 to 397
France	307	31,681	1 to 1,216
Switzerland	295	23,146	1 to 129
Sweden	293	42,354	1 to 115
Austria	124	18,050	1 to 1,318
Luxemburg	57	1,356	1 to 160
Italy	54	11,518	1 to 2,629
Russia	53	16,050	1 to 6,988
Spain	48	10,810	1 to 1,597
Hungary	36	8,458	1 to 2,168
Holland	31	7,680	1 to 615
Belgium	15	9,190	1 to 682
Roumania	6	243	1 to 13,616
Bulgaria	5	213	1 to 13,616

Western Telephone Construction Company.

There has been virtually a reorganization of the Western Telephone Constuction company of Chicago. Mr. Keelyn remains president of the corporation and he has also been made general manager of the business, with complete power in all departments. B. F. Stewart has been chosen secretary.

The company has decided upon a much more aggressive policy than that heretofore followed. It is already preparing for a large increase in its business, and its factory space will be at once enlarged 50 per cent.

The Telephone Situation.

By J. J. Nate.

Part III.

State Supervision

Referring to a means for establishing a uniform class of toll-line and exchange service, I have to say that no better plan can be adopted than that which the Bell company followed for several years; the employment of state or division superintendents, whose business it is to travel from point to point, and, after an inspection, recommend all necessary changes. Such men should be employed by the several state associations, and salaries made up among the exchanges in whose interest they are employed. They should be thoroughly experienced telephone men, of fair executive ability, and their recommendation to the owners of exchanges for alterations which would tend to bring about a uniform service should at all times be given heed to and the remedy applied at once. It will be seen that by such an arrangement a good salary can be paid at a very small cost to each exchange company, and thus able men can be secured for this important work.

Another very good means of accomplishing in part a similar result is concerted action on the part of home companies and the organization of state associations on a somewhat different basis than at present in vogue. Each state organization should assemble at least twice a year, while an international convention should be held at least once a year. I well remember in the first years of the Bell company's experience, when all were interested alike, how much good was accomplished in this way, and valuable information secured at very small expense. In state associations and in the employment of district superintendents, manufacturing companies should certainly have no voice and no interest. The business of a telephone manufacturing company is simply to sell apparatus. Operating companies do not need their assistance or direction in any particular whatever. As a rule, manufacturers are not more practical in exchange work than are promoters, and their advice is of little if any value, and sometimes proves most expensive, as recommendations are too often based on personal interest.

Patent Situation.

For three years this bugaboo has been prominently forced on the telephone public by the Bell company and its allied interest, and has undoubtedly proven a stumbling block to many, who, from timidity or want of opportunity, could not thoroughly inform themselves as to its true status. As a matter of fact, what is the situation? Simply this: It differs in no particular from other commercial, manufacturing or operative interests. Hardly a day passes during which some court or another is not called upon to decide the merit of patents which rival interests own, and which they wish to protect, and it is not at all strange that in the telephone business the same condition of affairs should exist, and, while I know that many of the patents owned and controlled directly or indirectly by the Bell company are of value, I am also perfectly satisfied that a large percentage of their so-called strong patents are entirely without merit and inoperative. It is true that the issue of a patent establishes an individual right to protection under the laws of our country, but the applicant must prove invention of a new and useful art, process, machine, manufacture, composition of matter or improvements thereon. How often this is done may be best illustrated by quoting from the "Report of the Commissioner of Patents for the Year 1893:" "Of 988 court cases reported in the Official Gazette, between 1886 and 1892, wherein patents were in litigation, 436 patents were sustained and 552 were declared invalid in whole or in part. Of the number declared invalid. 428 were by reason of some fault in the office, and 124 on account of evidence brought to light of which the office had no knowledge before granting the patents. * * * * Approaching the subject from another side, I am furnished with the result of examinations as to the validity of the claims in 10 patents, taken at random, where the searches in this office were made by a well-known law firm. These patents contain 50 claims, of which 35 were considered and reported to be old."

The question of infringement is separate and distinct from that of patentability. The courts deal only with the former. In view of the results shown in the report from which I have quoted, it is certainly reasonable to assume that in the telephone business the percentage of valueless patents should be, if anything, even greater.

Furthermore, the telephone at an early date seems to have been but poorly understood by the Patent Office, and many patents were issued where the magic word "telephone" seemed apparently to convey novelty and originality of invention, no matter in what sense applied; while the fact has to some extent been lost sight of that telephone, telegraph, electric-light and power work all belong to the same class--in other words, the same conditions for distribution of energy and operation enter into all, differing only as to the work for which

the apparatus is designed. As an illustration of the value of patents issued under such conditions, I may quote in part Judge Showalter of the United States Circuit Court at Chicago (see opinion handed down February 10, 1897, Western Electric company vs. Western Telephone Construction company, alleging infringement of the celebrated Watson patent). "In view of the state of the art, my judgment is that there is no novelty or invention in any of the eight claims, nothing more than the use of clever mechanical expedients in arranging a subscriber's outfit. The bill is therefore dismissed for want of equity." Many similar decisions can be cited having direct bearing on telephone and electric patents. From a careful examination and comparison of British and American patented invention of telephone apparatus, going back to the first patent granted Alexander Graham Bell, I gather sufficient information to feel quite sure that the independent telephone companies of this country have nothing to fear on that score, particularly if judgment is used in the selection of apparatus and a fair knowledge of the subject acquired before purchasing. There is no doubt that many good and valuable patents, controlled by the Bell company, are to-day being infringed by thoughtless or unprincipled manufacturers. I do not intend to imply that because a patent has issued, manufacturers should keep hands off, but I do assert that a reckless use of apparatus, without the advice and sanction of well-informed legal counsel, is a practice which must in the end cause needless expense both to manufacturer and purchaser alike.

Fighting the Bell Company.

In Simon Sterne of New York the Bell interests have found a foeman worthy of their steel. Mr. Sterne has persistently fought the local telephone company and thus far has had the best of the scrimmage. Last week the telephone people tried a new dodge. Counsel for the Metropolitan Telephone and Telegraph company asked Justice Giegrich in the Supreme Court March 18th to discontinue an action brought by Simon Sterne to enjoin the company from removing a telephone from his law office. Justice Giegrich reserved his decision. The action was begun in 1895, when the telephone company served notice on Mr. Sterne that, with a number of other subscribers, he must pay $240 a year for his telephone instead of $150. The company was dissolved in 1896, and the business was taken over by the New York Telephone company.

W. B. Hornblower, who appeared for Mr. Sterne, opposed the motion, and asked that the New York Telephone company be added as a party defendant to the suit. He said that the act under which the old company dissolved especially provided that it should continue in existence for the purpose of discharging its obligations, and could sue or be sued. Mr. Hornblower said that Mr. Sterne wanted the new company added as a defendant in order that when the suit came up for trial a final adjudication might be made on the question.

Counsel for the Metropolitan company said that he could not consent to or oppose the motion to add the new company as a party defendant, as he did not appear for that corporation.

Mr. Hornblower said: "The New York Telephone company not only has taken over the business of the old company, but is now the owner of the very instrument now in dispute. We have the same right to bring in the new company as we would have to bring in the purchaser of a piece of property which had been transferred to get the former owner out of the consequences resulting from an action against him for maintaining a nuisance."

Southern Telephone Notes.

A correspondent at Greenville, Tenn., writes that the independent movement is strong in East Tennessee and that independent telephone exchanges have been established from one to three years in Knoxville, Morristown, Greeneville, Jonesboro, Johnson City, Bristol, Elizabethton, Newport, Maryville, Clinton and Coal Creek; that they are all connected by long-distance lines, and that they are cutting "deep holes" into the heretofore large revenues of the "East Tennessee (Bell) Telephone company."

A company is being organized at Winnsboro, S. C., to establish a telephone system. J. M. Beaty is interested in the scheme.

The Versailles (Ky.) Telephone company has been organized with a capital stock of $5,000. B. B. Smith is the president of the company.

Increase in business has necessitated an addition to the switchboard of the Las Vegas Telephone company of Las Vegas, New Mexico. The company added 20 drops to the board on February 1st, and has five of them already in use.

The Mutual Telephone company has been organized at Ronceverte, W. Va., with an authorized capital of $10,000, to construct a telephone line from Marlinton to Monroe Academy, Pocahontas, Frankfort, Lewisburg, Ronceverte and Greenbrier via Organ Cave, Pickaway and Union.

The People's Telephone and Telegraph company of Knoxville, Tenn., is planning to put up a magnificent fireproof building in which to house its central office, electrical laboratories, general repair shops and general offices. It has also perfected its plans for placing its wires in conduits throughout the business section of the city. The company hopes to begin the work proposed by the first of next year, and have it completed in sufficient time to occupy the first of June of next year. The People's company is purely a home institution, and it is stated that the capital required to accomplish this improvement will be furnished by Knoxville men.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Rock Island, Ill., telephone exchange, which was burned out some time ago, has resumed operations.

A new telephone system will be constructed at Sault Ste. Marie, Mich.

The Jefferson County Telephone company will extend a line to Batavia and Packwood, Ia., if granted a franchise at the spring elections.

The telephone companies at Boone and Marshalltown, Ia., will extend their lines to connect their systems this spring.

A telephone line will be built from New Prague, Minn., to Wesley, Minn., this spring.

A telephone line is to be constructed between Ringgold, Watterson and Caledonia, Ia. A. L. Case is general manager.

The Mississippi Valley Telephone company franchise has been passed by the Assembly committee on streets.

It is reported that the Iowa Telephone company offers to reduce its rates at Muscatine, Ia., about one-half, if the Hubinger company is refused a franchise.

It is again rumored that the head offices of the Iowa Telephone company are to be removed from Davenport to Des Moines.

The Western Electric Telephone company proposes to extend its lines west from Pipestone, Minn., to Madison, S. D.

The Iowa Telephone company has made a rate of $1 per month for a six-party line service at Des Moines for residences.

The Forman Telephone company, which operates the exchange at Lisbon, N. D., has reduced rates to $1.50 and $1 for business houses and residences. The projected local company has been abandoned in consequence.

Mr. Hungerford, of the Billings, Mont., telephone system, has made a proposition to the council of Miles City, Mont., to put in an exchange there.

The Union Telephone company has been organized to connect Wautoma, Wis., with Hancock, Plainfield and other points. Work will be begun in the early spring.

The Spokane and British Columbia Telephone company is constructing lines between the Columbia River and Republic, and will soon begin work on a line between Rossburg and Grand Forks, B. C.

Albia, Ia., will vote March 28th on granting a franchise for a telephone exchange.

The Northwestern Telephone Exchange company is arranging for a right-of-way to Princeton, Minn.

T. F. Robinson of Tracy, Minn., has been granted a franchise for a telephone exchange in St. James, Minn. Mr. Robinson has exchanges at Tracy, Marshall and Pipestone.

The Perry Telephone company proposes to connect with Guthrie Center, Ia., and establish an exchange there.

The telephone company of Anaconda, Mont., inaugurated night service March 15th.

J. C. Hubinger of Keokuk, Ia., has been granted a franchise for a telephone exchange in Muscatine, Iowa.

M. Plank and Dr. F. A. Wood of Hancock, Wis., propose a telephone line to connect Plainfield, Hancock, Coloma, Coloma Corners and Wautoma, Wis.

The stockholders of the Richland County Telephone company and the Grant County Telephone company held a meeting in Richland Center, Wis., recently and organized a new company to conduct the business of both concerns and build several hundred miles of new lines. The consolidated company will be called the Union Telephone company, and will have a capital stock of $100,000. It now owns 650 miles of toll lines and [illegible] good exchanges. The following named officers [illegible] elected: President, J. D. Holford, Bloo[illegible] vice president, C. H. Pease, secretary and treasurer, L. M. Pease; directors, A. M. Stratton, G. C. Marlo, Bloomington; Theo. Wheaton and J. Robert Coumbe. This company, since its reorganization, is considered one of the strongest in the state outside of the Wisconsin Telephone company.

Telephones and Railroads.

[illegible]

In the United States nearly 800,000 telephones are now in use, with 600,000 miles of telephone wire, 350,000 telephone stations, and it is said, nearly 3,000,000 telephone messages daily. In many cases where formerly the transaction of business involved a railroad journey, the telephone renders it unnecessary, and accordingly the passenger receipts of railroads have suffered to a considerable extent, at least their normal growth has been checked. It is noticeable that where the telephone service is imperfect or undeveloped this effect is not marked.

Independent Telephone Movement on the Pacific Coast.

An esteemed correspondent writing from Sacramento furnishes the following interesting information respecting the progress of the independent telephone movement on the Pacific Coast:

"I have often felt that the telephone companies of the East might find some interest in knowing that the Capital Telephone and Telegraph company of Sacramento, Cal., has been engaged in lawsuits with the Western Electric company of Chicago and the Sunset-Bell company of California since October, 1895. With the former, one suit was on the Watson automatic switch, which has been dismissed, the other being on the use of the multiple switchboard. The latter case was argued on November 11th, 12th and 13th, in the United States Circuit Court in San Francisco, by Mr. Roberts of Boston, George P. Barton of Chicago and E. S. Pillsbury of San Francisco, supported by Expert Scribner for the complainant, with John H. Miller of San Francisco, Charles C. Bulkley of Chicago and L. T. Hatfield of Sacramento for defendant. No decision has yet been reached, but whatever it may be it cannot affect the operation of the local exchange, as it has never worked under anything but the 'trunking' system. The suit with the Sunset-Bell company, which should have been decided weeks ago, was relative to the use of its instrument. After transmitting a number of territorial messages for the Capital company the Sunset company refused to give further service in that direction, claiming that such messages were not upon the Capital company's own business and that it had violated its contract. The Sunset company demurred to the complaint, but was overruled and compelled to make answer. Since the overruling of demurrer the Sunset company allows the Capital company the use of the instrument for all purposes, repeating messages for subscribers throughout the state, etc. While the Pacific Coast is a little backward in the number of its independent telephone exchanges, Portland, Oregon, San Jose, Santa Cruz and Sacramento, Cal., being the only ones, I am satisfied it will not be long till San Francisco has a powerful organization to meet the Pacific-Bell in its great stronghold, as also will Los Angeles."

Bellamy's Ideas in Practice.

By E. C. Dickinson.

In Augusta, Ga., an automatic telephone exchange has been installed about a year. It is needless to say that the Bell people fought hard to hold their own, but the automatic company, with local capital and a mutual interest, opened and grew in spite of all efforts on the part of the old company. When the fight was hottest Sam Jones appeared upon the scene and opened his meetings in an old warehouse with long rows of rough planks as seats, and heaps of sawdust on the floor, presumably to save the knees of his congregation. Many good, bad and indifferent people did not take kindly to the accommodations furnished in the tabernacle, as it was called, and staid away.

At this juncture the electrician of the Automatic company came to the rescue and placed two long-distance telephones on two wooden posts in front of the platform in such a way as to catch the voluminous outbursts of the speaker.

Sam Jones was given a number, and anyone of of the 350 subscribers then being served could call up the tabernacle and hear a sermon while sitting quietly at home. The novelty attracted the people and as many as 250 subscribers listened to these sermons over the lines at one time. When the speaker stood directly in front and within 10 or 15 feet of the transmitters, the sermon could be heard very distinctly. The music, which was at least 25 feet from the telephones, was very clear and loud, musical sounds, as is well known, being much more readily transmitted than spoken words.

The Bell people were in the field, but with their limited number of cords they could only accommodate about 20 people at a time.

It is not incredible to predict that some day, instead of depending on a tri-daily paper for news three or four hours old, we will settle back in our easy chairs and listen to the events of the hour.

COMMUNICATION.

Telephone Taxation in Georgia.

To the Editor of the Western Electrician:

"I desire to direct attention to the unjust and burdensome tax which the Legislature of Georgia put upon telephones some years ago. The amount is $1 for each instrument, which, in addition to city taxes, makes it hard on independent companies which have cut prices so low that there is little profit remaining. We hope to get this law repealed at the next session of the Legislature if the independent interests will all take hold and work in harmony.

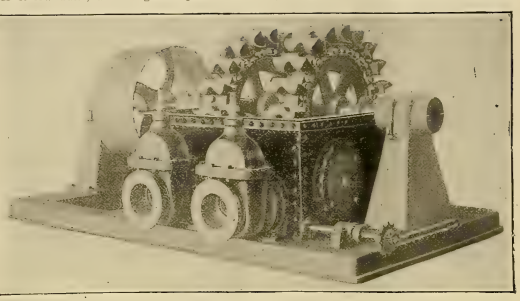
The law was made when the Bell company had a monopoly and charged extortionate prices.

W. E. WHITEHEAD.

Carrollton, Ga., March 5, 1898.

Interesting French Power Plant.

A striking example of the utilization of water power made possible by wheels of the impulse type is presented in the arrangements recently made for power in the textile goods factory of M. Benoist Cadet Fils in La Bastide, a town south of Bordeaux in the Department of Tarn, France. Here a steam engine which formerly was used to furnish the power for the entire factory is now held in reserve for periods of low water, and the greater part of the

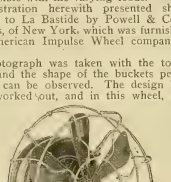


INTERESTING FRENCH POWER PLANT.

time power is furnished by a 36-inch twin impulse wheel, working under a head of 128 feet at 285 revolutions per minute, and developing 40 horse power. The use of contracting nozzles makes a high efficiency possible with the varying loads.

The illustration herewith presented shows the wheel sent to La Bastide by Powell & Colne, export agents, of New York, which was furnished them by the American Impulse Wheel company of the same city.

The photograph was taken with the top casing removed, and the shape of the buckets peculiar to this wheel can be observed. The design has been carefully worked out, and in this wheel, as in all



GENERAL ELECTRIC FAN MOTOR.

others made by the American Impulse Wheel company, the mechanical workmanship is seen to be excellent.

The high efficiency of the wheels made by this company is due to the close attention and study which its engineers have given to every detail and to the great care exercised in manufacturing. A prime mover with so low a first cost, and almost negligible expense for repair, requiring little or no attention while running, is an attractive one to large number of manufacturers who are at present burdened with heavy expenses in connection with their motive power.

The possibilities of the electrical transmission of energy are now so great that many concerns might at comparatively small expense utilize water powers even though they are located at considerable distance from their establishments. All inquiries on this subject which the American Impulse Wheel company receive have the careful consideration of their engineers, and as full information is sent in reply as the data presented will permit.

General Electric Fan Motor.

The '98 models of the General Electric company's fan motor are announced as the latest of a long line of successful designs. These fan motors are built for both alternating and direct-current circuits.

That for alternating currents, shown by the cut, is an induction motor, carefully proportioned in all its parts as are the larger machines which this company builds, except as to air and bearing under continuous operation being absent from the small as from the large. The cast-iron frame which supports a single long bearing are bolted the soft iron laminations which make up the field core, provided with inwardly projecting teeth to form the poles on which are placed the field coils wound with an ample quantity of wire and thoroughly insulated. The armature is built up, also, of soft iron laminations, assembled on a brass spider, but has no insulated wire. Bare copper rods run through the core, and are riveted into disks at each side. Rotation being produced by inductive action, no commutator or brushes are required. The armature overhangs the bearing, and, with the fan, rotates well balanced on the single bearing. An automatic oiling device gives perfect lubrication without oil throwing, and this, together with the long bearing, ensures a continuous cool operation. The alternating fan motor is built for 52 and 104 volts, 60 and 125 cycles, and is provided with a speed-regulating device consisting of an inductive resistance cut in or out by a three-point switch. Movement of the switch over the first two points gives full speed and half speed and on the third cuts the motor out of circuit. No additional switch is necessary.

The direct-current fan motor is as equally compact and carefully designed as that for alternating currents, and in appearance and general construction closely resembles it. Laminated soft iron of the best quality is used throughout for the magnetic circuits; all windings are thoroughly insulated, and commutator connections carefully made. As in the alternating motor, fan and armature revolve in a single, long, self-oiling bearing. The commutator is completely enclosed, and the carbon brushes encased in small tubes, which are readily unscrewed for inspection. A regulating switch provides for variation of speeds. The alternating-current fan motor may be, if desired, mounted on trunnions to allow of adjustment of the fan to blow in any direction. The motors are finished in black enamel, the fan guard and trimmings in polished nickel.

Potential Transformers.

Potential transformers are designed to furnish current for either voltmeters or wattmeters. In common with other manufacturers, the General Electric company has heretofore mounted its smallest standard lighting transformer on a slate or marble base, and supplied it to furnish current for instruments without changing its rating as a lighting transformer. It was thus allowable to load the transformer up to its full rated capacity with lamps and instruments. Since the ratio of transformation of a small lighting transformer varies some 2½ per cent. to three per cent., whether the lamps are burning or not, this practice is open to serious objection. The defect is doubly objectionable now that instruments of far greater accuracy than formerly are made. The absurdity of producing instruments accurate within one per cent., when the error is to be increased to three per cent. or more by using them in connection with a transformer with a variable ratio of transformation, is quite obvious. Potential transformers are not of sufficient output to load with lights, and they give the correct ratio of transformation at their rated output instead of at no load, as is the case with all other transformers. The rating assigned them is 10 watts, which is ample to supply one General Electric inclined-coil voltmeter and one single-phase recording wattmeter. They can be safely loaded to 50 or 60 watts for a few minutes and are thus adapted to furnish current to phasing lamps, in circuit long enough to synchronize the machines to which they are connected.

To meet various conditions the General Electric company has designed five different potential transformers. The first (Fig. 1), wound for 1,040 volts primary and 52 volts secondary for frequencies 60 to 125 cycles, is intended for use on circuits the voltage of which does not exceed 1,250 volts, to supply current to indicating voltmeters reading to 75 volts and to primary recording wattmeters.

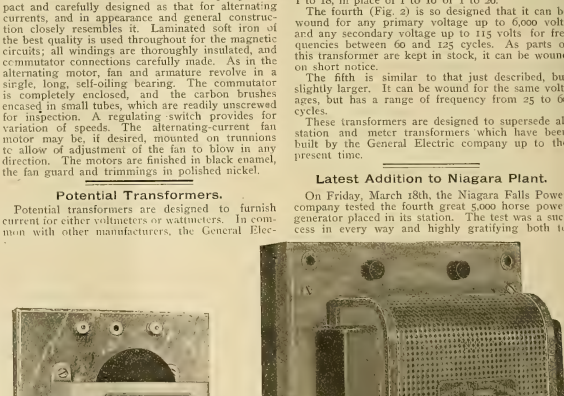
The second, wound for 1,040 or 2,080 volts primary and 52 or 104 volts secondary for frequencies of 60 to 125 cycles, furnishes current for indicating voltmeters reading to 75 or 150 volts, and is so wound that coupling the coils differently for use on different voltages is unnecessary. It has ample carrying capacity in the winding to give its full output on the lower voltages when only one-half of the winding is in use. Three primary and three secondary terminals are provided. If the transformer is used on 2,080-volt circuits the two outside primary terminals are connected to the lines. If, however, it is used on 1,040-volt circuits, the middle terminal and either outside terminal are connected to the line. By making similar connections on the secondary side either 52 or 104 volts can be obtained.

The third, wound either for 1,040 or 2,080 volts primary and 57½ or 115 volts secondary for frequencies of 60 to 125 cycles, is identical in its construction and use with the second, except that it is wound for stations using a ratio of transformation of 1 to 9 or 1 to 18, in place of 1 to 10 or 1 to 20.

The fourth (Fig. 2) is so designed that it can be wound for any primary voltage up to 6,000 volts and any secondary voltage up to 115 volts for frequencies between 60 and 125 cycles. As parts of this transformer are kept in stock, it can be wound on short notice.

The fifth is similar to that just described, but slightly larger. It can be wound for the same voltages, but has a range of frequency from 25 to 60 cycles.

These transformers are designed to supersede all station and meter transformers which have been built by the General Electric company up to the present time.



FIGS. 1 AND 2. POTENTIAL TRANSFORMERS.

Latest Addition to Niagara Plant.

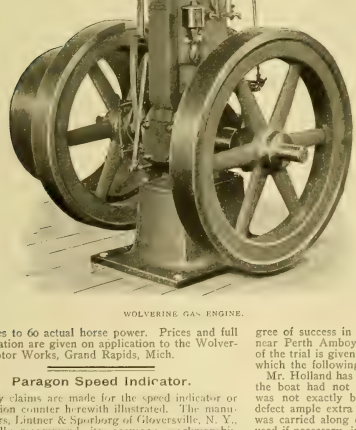
On Friday, March 18th, the Niagara Falls Power company tested the fourth great 5,000 horse power generator placed in its station. The test was a success in every way and highly gratifying both to the power company and to the Westinghouse Electric and Manufacturing company, the maker of the dynamo. This brings the capacity of the station up to 20,000 electrical horse power, and is the first of the new dynamos to be installed and operated. Additional dynamos of the same design, make and size will be installed in the power house, until the total output of electric current reaches 50,000 horse power.

K. & W. Hanger-board.

Illustrated herewith is the K. & W. hanger-board and absolute cut-out combined, which is manufactured by the K. & W. company, Pittsfield, Mass. The board has been designed to meet the various requirements occasioned by the different types and makes of arc lamps. The base is of slate, japanned black, and is made solid or with an oval hole in the center large enough to pass the stack of a single or double-carbon lamp. The methods of lamp suspension are simple and are suitable for lamps with terminals close together or wide apart, or for lamps supported by a single eye at the center. The hanger-board is also well adapted for attaching to lamp hoods. The slide-rod is actuated by an insulated handle controlled by a spring, which throws the handle either side of the center. The handle is drilled for the insertion of a cord for operating it at a distance. It can also be operated by hand or with a pole. The contacts are of phosphor bronze and all parts are dipped or polished and lacquered, making a board of handsome appearance. The operation of the slide-rod is first to shunt the lamp and then cut it in or out entirely, and absolutely without sparking. The reception the board has met bears evidence of the high grade of workmanship for which all the products of this progressive company are noted.

Wolverine Gas Engine.

The accompanying illustration represents a six horse power Wolverine stationary engine, especially designed for electric-lighting purposes and for all other purposes where a steady power is required. For several years electrical engineers have been on the lookout for a good gasoline or gas engine for driving dynamos, and the Wolverine has been brought out to meet their requirements. The trouble with the ordinary gas engine of the four-cycle type has been in the unsteadiness of operation, producing a pulsating light. To overcome this unsteadiness in operation, it was necessary to use countershafting, with a heavy balance wheel. The Wolverine engine has an impulse at every revolution, runs at high speed, and has two heavy fly-wheels, which entirely overcome the unsteadiness of operation common to other forms of gas engines. The governor on this engine is very sensitive, and operates on the inlet valve which admits gas into the upper end of cylinder. The quantity of the gas is varied as the load on engine increases or decreases, the quality of the mixture of gas remaining constant. The manufacturers of these engines guarantee them to produce a steady light without any perceptible pulsation, when belted direct to the dynamo, without the use of any intermediate countershafting. The consumption of gasoline is said to be one-tenth of one gallon per hour per actual horse power. The Wolverine engines are built in all sizes to 60 actual horse power. Prices and full information are given on application to the Wolverine Motor Works, Grand Rapids, Mich.

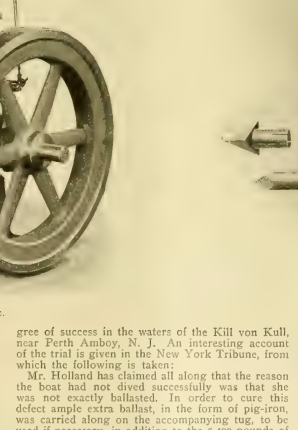


WOLVERINE GAS ENGINE.

Paragon Speed Indicator.

Many claims are made for the speed indicator or revolution counter herewith illustrated. The manufacturers, Lintner & Sporborg of Gloversville, N. Y., especially recommend its accuracy, workmanship and durability. These advantages are as cited:

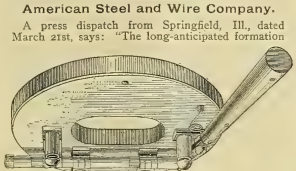
The indicator registers continuously from 0 to 5,000 revolutions per minute and then goes on and repeats, but if continuous counting is not required the register is easily and instantly turned to zero for a fresh start. It has a pistol-form grasp by which the contact is made, and a trigger-form lever for starting the registering dial, just the form of mechanical appliance to secure accuracy at starting and stopping. The spindle of this instrument may be placed in position and may be running all right, but no count will be made until the trigger is pulled. It is provided with ball bearings, to take up the end-thrust friction. The latter disappears as a defect, and overcomes the liability of slipping at the contact point and making an incorrect record. It is also provided with worm gears to actuate the dial. No matter in which direction the spindle turns, the recording dial always turns and counts in one direction, so that its recordings do not have to be read backward. The indicator is packed in a leather plush-lined case, with compartment for extra contact points, tools, etc. The cover when closed is secured with ball and socket fasteners. The case is 6½ inches long, 3½ inches wide and 1¾ inches deep. Its weight, including indicator and equipment, is 14 ounces.



PARAGON SPEED INDICATOR.

American Steel and Wire Company.

A press dispatch from Springfield, Ill., dated March 21st, says: "The long-anticipated formation



K. & W. HANGER BOARD.

of the gigantic wire and steel trust was completed this morning by the secretary of state granting license for the incorporation of the American Steel and Wire company, with principal offices located at Chicago. The object given for the organization is 'manufacturing and mining and all business relating thereto.' The capital stock is placed at $24,000,000, the largest capitalized company in the West. The incorporators are John W. Gates, Isaac L. Ellwood and Ethelbert H. Gary. The life of the corporation is given at 99 years. The fee for the incorporation was $24,500, the largest single fee ever received for an organized company in the West."

Successful Trial of the Holland Submarine Boat.

On March 17th the submarine boat designed by John P. Holland was tested with a considerable degree of success in the waters of the Kill von Kull, near Perth Amboy, N. J. An interesting account of the trial is given in the New York Tribune, from which the following is taken:

Mr. Holland has claimed all along that the reason the boat had not dived successfully was that she was not exactly ballasted. In order to cure this defect ample extra ballast, in the form of pig-iron, was carried along on the accompanying tug, to be used if necessary, in addition to the 5,400 pounds of ballast which the boat already carried.

The first attempt of the boat to dive was hardly to be called a success. Slowly her bow sank and her stern rose until the torpedo tube at her stern showed clear, while her propeller, partially in the air, was churning the water into foam. She then ran in semi-circles for some little distance, but could not force her nose deeper than the conning tower into the water.

Mr. Holland finally gave it up, and signaled to the tug for more ballast. Two hundred pounds of ballast was accordingly added. But the desired result was not secured. Two hundred and fifty pounds more of pig-iron was then stowed away, and off she went again. This time the Holland went all but under, only the top of her conning tower and her flagposts showing.

After further addition, together with some slight shifting of the ballast already in the boat, the Holland started off. Suddenly she dived and simultaneously the tug's whistle shrieked and every one on the tug burst into cheers, for the boat wholly disappeared save her flagstaffs, and from the position of these at least 2½ feet of water must have flowed over her conning tower and six feet over her hull.

After covering some 250 yards under the water, the Holland came again to the surface and after a short run made another dive. This time Mr. Holland sent her underneath the water for more than a quarter of a mile at good speed, and again coming up she gave three blasts of her impertinent little whistle to signify that the day's experiment was over.

As the tug drew alongside, the cover of the conning tower was thrown back, and the smiling, satisfied face of the inventor appeared. Mr. Holland climbed on the deck of his boat and informed the captain that he wanted to be towed back to the wharf, as the electric batteries were weak. This evidently exasperated the electrician, for his angry face appeared above the turret, as he asked: "And is it like a lame duck yez want to go back after such a performance as that?"

"Do you think she can run back under her own power?" mildly queried Mr. Holland.

"Run back under her own power!" shouted the electrician. "Sure, she could run to Jerusalem." And back she accordingly went without the aid of the tug.

The Holland is the second type of this particular boat to be built by Mr. Holland. The other one, called the Plunger, is now being built under contract with the government at Baltimore. Mr. Holland determined to build this boat because he did not like, and thought he could improve upon some of the specifications insisted upon by the Navy Department.

The boat is 45 feet in length, with a diameter of eight feet. She tapers away greatly toward the stern, where a torpedo-tube is located just above the propeller. Another torpedo-tube is in her bow. She also carries two dynamite guns capable of throwing a projectile upward of a mile. These guns are on pivots at the bow and stern.

Her superstructure is cigar-shaped, and about 25 feet long, with her conning tower some 2½ feet high, located just forward of the center. The turret also has cutwaters fore and aft to relieve the water pressures when the vessel is running awash. The boat is designed to run for at least 50 miles under water, and to be able to descend to a depth of 40 feet. In copper cylinders sufficient air is carried to supply her crew for at least six hours, and should it be necessary for her to remain under for a longer time a rubber tube on a float has been designed to give her connection with the surface and through which her air supply can be renewed. On the surface she is run by a gasoline engine, while below the motive power is electricity, with storage batteries of sufficient power to drive her 50 miles without renewing.

The method of sinking her is by admission of water ballast into various compartments on her sides, and, on wishing to rise, the water in its turn is expelled by compressed air. This, together with her diving rudders on the sides, enables her to disappear when going at full speed.

Telephotos in Naval Service.

Whatever may be the true reason, the present strained relations between this country and Spain are credited with hastening the equipment of United States naval vessels with a new signaling system.

The apparatus of the Telephotos company of Buffalo has been approved by the United States Navy Department and the company has received orders for several sets to fit out American warships. The telephotos is considered the most rapid, most powerful and effective night-signal system yet invented. It is the conception of C. V. Boughton, who is the general manager of the company manufacturing the apparatus. In its operation the electric current plays a leading part, rendering it thoroughly effective and brilliant on the darkest nights. The orders which the company is now filling were received after a severe trial on board several vessels equipped for experimental purposes. The tests were highly satisfactory, fully confirming the excellent impression created by previous tests, and now the Navy Department has decided, it is understood, to equip all United States warships with the system.

The telephotos consists of a series of four double lanterns, lighted by powerful groups of incandescent lamps, the four double lanterns being hung vertically on strong wire cables, the upper end of which can be run up to a mast or yardarm, while the lower end is intended to be fastened to the deck of the vessel. The upper half of each lamp is white and has within it a group of three lamps surrounded by powerful magnifying lenses. The lower half is red and has four lamps, in order to make the red beams the stronger, which are surrounded by heavy red lenses. The carefully insulated cable connects the lamps and passes from the lower end to the deck or the bridge, where a keyboard enables the operator to spell out the code signals about as rapidly as a typewriter is manipulated, and very much in the same manner. The keyboard is arranged on a standard and enclosed like a binnacle, the operator standing in front of it while manipulating the keys. By a simple automatic arrangement, each key as depressed lights a combination of the four red and the four white lights, making a letter or a number according to the code of signals. All of these operations are automatic and the combination is made by one touch of the key. Another feature of the keyboard is that when one letter is down all the other keys are locked so that another cannot be accidentally pushed down and confuse the signals. Any key pressed down can be turned one-quarter way round, like a screw, which motion locks it in place and leaves the signal burning in case it is desired to use it as a standing signal or order in the secret naval code. Thus the keyboard can be used to telegraph ordinary instructions by the usual letters, to send a cipher dispatch or special-code orders. Notwithstanding all this apparent complication, the keyboard and contact and its mechanism so simple that it cannot be readily disturbed or gotten out of order.

It is claimed that the telephotos has created a good impression in the British navy, and that a number of sets have been ordered for the finest English vessels.

Activity in the Copper Market.

Writing to the Chicago Times-Herald, a Houghton, Mich., correspondent states that while the talk of war has been felt to some extent in the market for mining shares, it has by no means injuriously affected activity in actual mining. With copper selling at better than 12 cents, a war would be more likely to raise than depress prices. Twelve-cent copper means annual profits of nearly or quite $7,500,000 by the mines of Houghton County. On the output of 150,000,000 pounds of refined copper, which was nearly reached in 1897 and will be exceeded in 1898, the mines of Houghton County gain 1½ net profits $1,500,000 on every increase of one cent per pound in the selling price. There is not a producing mine in the district which cannot maintain the present high wages and earn a profit on 10-cent copper. At the present time there are approximately 10,000 men employed in the mines and mills of the Lake Superior copper district at wages never exceeded. It is a matter of general comment by visitors that the Lake copper district is more prosperous than any other district in the United States, if not in the world. The activity now manifested in reopening old mines bids fair to greatly increase the number of employes and of producing mines.

A London dispatch of last Saturday states that there is extraordinary activity in the copper market, especially at Birmingham. Authorities agree that the supplies are manifestly scarce, and that the stocks are unprecedentedly low. Good brands have advanced £2 10 ton since January 1st. The activity is largely attributed to the projected expenditure of the United States for war material, and a possible rupture with the principal copper countries.

Troubles for Acetylene Promoters.

[Special dispatch to the Western Electrician.]

Niagara Falls, N. Y., March 22.—The Electrogas company has foreclosed upon the Acetylene Light, Heat and Power company.

CORRESPONDENCE.

New York Notes.

New York, March 21.—Acting on the report of the committee to which the matter was referred, the Rapid Transit Commission has passed upon the Manhattan Railway company's application for permission to make elaborate extensions to its elevated railroad system. In general, the commissioners accede to the Manhattan's requests, but with some important modifications. The company is urged to change its motive power and is given 30 days, after the preparation of the "detailed certificates" of the franchises, to accept or reject the conditions imposed for the construction and operation of the new routes. The commissioners make it evident that they have not abandoned their own tunnel-railway scheme in the following paragraph of the adopted report: "We cannot approve the suggestion made to us by the president of the Manhattan company that it be granted an underground route under the boulevard. That would imply the destruction of the real and sufficient rapid-transit plan for which the people of the city have voted, which has been repeatedly approved by practically unanimous votes of the Legislature and practically unanimous action of the city authorities, and which has now reached the stage of actual appellate division. Those routes and plans should be scrupulously observed and carried out. There is no possible room for doubt that the elevated-railroad system, however extended and improved, will in a very brief time have all the capacity it can carry. There will in addition be business more than sufficient to make profitable a modern rapid-transit road, built in accordance with the plans so universally approved. These plans represent years of labor, vast detail and a very considerable expense incurred by the city. To destroy them by surrendering an essential feature to the Manhattan company would be a deliberate and serious sacrifice of the future interests of the city."

It is expected that electric cars will be running in upper Eighth avenue this week. These cars will start at One-hundred-and-fifty-fifth street and run to Fifty-ninth street, where they will turn east. At Lexington avenue they will be switched back. Part of the Second avenue line will be equipped with electricity this spring.

The Kings County Electric company, which is rushing work on its plant at the end of Gold street in Brooklyn, in order to start operations by early summer, has contracted to furnish almost its entire capacity of more than 20,000 horse power before the engines have turned a single revolution. The directors of the company, it is asserted, are considering the feasibility of buying more ground and extending the plant at an early day. "The increase in the use of electricity," said one of the directors of the company to a Tribune reporter recently, "is one of the most remarkable tendencies of the present day. So far as I am able to learn, not much of the business we have secured has come from existing companies. It is nearly all new. The use of electricity is only in its infancy in Brooklyn. It is the coming power that manufacturers will and is sure to use, not steam in a few years. The Worthington Pump Works in South Brooklyn have taken the initiative in discarding steam for electricity, and by this example will be followed in a few months by a number of establishments whose owners are 'keeping tab' on the results obtained by the Worthingtons. The change is taking place so gradually that it attracts far less attention than it deserves. It is a process of evolution marking a passage from a lower to a higher industrial development."

Part of the $50,000,000 appropriated by Congress as a national defense fund will go to electrical manufacturers. In a few days bids will be solicited for placing telegraph cables to connect Governor's Island with Sandy Hook, Fort Wadsworth and Fort Hamilton, and for running private land telegraph lines between Willets Point, Fort Schuyler and Fort Slocum, with connections to Governor's Island.

The Consolidated Electrical Conduit company of this city, which holds the right to equip the canals of the state with appliances to propel boats by means of electricity, has filed in the office of secretary of state a certificate of continuance of its corporate existence for five years, from November 3, 1898. The company was originally incorporated in 1893, for a period of five years. The certificate is attested by Frank W. Hawley, Charlton T. Lewis, William Mertens, C. P. Wedder, J. S. Bache, Charles Ambrecht and Peter F. Meyer. M. S.

PERSONAL.

President Insull of the National Electric Light association says that great interest is shown throughout the East in the forthcoming convention of the association in Chicago. Mr. Insull returned to Chicago on Monday after a two days' eastern trip.

Colonel John C. Van Dozer, an old-time telegrapher, is dead. During the war he was superintendent of military telegraphs at Nashville and a member of the staff of General Rosecrans, who died this month. Col. Van Dozer died in Escanaba, Mich.

J. H. Hallberg, electrician of the Standard Thermometer and Electric company of Peabody, Mass., after three weeks' stay in Chicago, has left for the East, returning to Massachusetts by way of Cincinnati, Pittsburg and New York. Mr. Hallberg's new series lamp with enclosed arc has attracted much attention.

Frank B. Rae has been retained as consulting engineer by the Crane Elevator company and the Calumet Electric Street Railway company. The latter is owned by the National Bank of Illinois, which is in the hands of Gen. John McNulta, receiver. Mr. Rae is also overhauling the steam plant of the Ludowici Roofing Tile company at Chicago Heights.

Louis A. Ferguson, general superintendent of the Chicago Edison company, has returned from a five weeks' visit to England, France and Switzerland. Mr. Ferguson corroborates the stories that have been received from all visitors to England that there is great activity in electrical work. He says that Americans are taking advantage of the "boom" and that they are leading in all the great undertakings.

Mr. R. McRae, electrician and expert for the Electric Storage Battery company of Philadelphia, is in Chicago engaged in the important work of installing the large storage battery that is to assist in carrying the load of the Chicago Edison company's system. Mr. McRae is one of the oldest and most experienced storage-battery experts in this country. He studied under Sir William Thomson (now Lord Kelvin) in England, and has held various important positions since coming to this country, about 15 years ago. It is safe to say that this important installation could not have fallen into better hands. Mr. McRae has recently been doing most excellent work for the company in Pittsburg, where a large battery has been placed in position to act as an auxiliary source of supply to one of the Pittsburg street-railway companies.

Many friends will regret the announcement of the decease of Mr. Jules Viennot of Philadelphia, which occurred at his late residence, 4424 Chestnut street, on March 11th, after a brief illness. Mr. Viennot was 72 years of age and had for the last 15 years conducted one of the largest advertising agencies in the country. His special efforts were centered in the mechanical trade, and by his strict integrity and upright dealings he built up a business which has among its clients some of the largest manufacturers in the country. Mr. Viennot was universally respected by all with whom he came in contact, and his kind consideration and help will be long remembered by many newspaper representatives with whom he did business. He was born in Paris, and came to this country 50 years ago. He was a member of the Franklin Institute and of the French Benevolent association. Some two years ago the honor of being an Officier De L'Academie was bestowed upon him by the French government. The business will be conducted by his estate, under the management of Mr. J. A. Thompson, a gentleman who has been connected with Mr. Viennot many years. He is fully capable of caring for the business, after the long training he has had.

ELECTRIC LIGHTING.

Irving & Hackaday have purchased the electric-light plant at Itasca, Texas.

Blake Dupree, receiver of the Citizens' Electric Light and Power company of Galveston, Texas, has applied for permission to issue receiver's certificates for $20,000, to be expended in improvements to the plant.

The Winnsboro (S. C.) Electric Light and Power company will erect a plant for 750 incandescent lamps, costing about $3,000. A water-works system will probably be constructed later on. R. G. Andrews is president of the company.

The Chicago, Rock Island and Pacific Railroad company has decided to equip all engines which haul important passenger trains at night with electric headlights, but the ordinary headlights will not yet be discarded on all passenger engines.

The Mutual Light and Power company and the Montgomery Light company of Montgomery, Ala., have consolidated and reorganized, electing W. F. Vandiver, president; C. G. Armstrong, vice-president, and B. S. Maultsby, secretary. The company will expend about $150,000 in improvements, which will include new gas plant, two new boilers, a 1,000 horse power engine, etc.

The Boston and Albany Railroad company is experimenting with the car-axle system of train lighting. A dynamo is mounted on one of the axles and operated by gearing. The current generated goes directly to the lamps or to a storage battery if the lamps are not in use. An automatic cut-out disconnects the dynamo from the battery when the speed falls below a certain amount—variable at pleasure—so that the batteries cannot discharge through the dynamo. When the train is standing at a station or elsewhere, the lights are maintained by the batteries, which are of sufficient size to keep them burning for 10 hours. Nineteen lamps are in the body of the car, and one over each platform. A pole-changing device maintains the correct polar-

ity of the current through the batteries when the car runs in the reverse direction. An officer of the railroad company says that no extended trial of the appliances has yet been made, and only one such car is as yet in use, but it gives a good light, and thus far works pretty well.

The following bids were received by the United States engineer at New London, Conn., for electric lighting and power installation at Great Gull Island, New York: McKay Howard Engineering company, Baltimore, Md., entire plant, $5,290 (recommended for acceptance); Randall P. Barron, New York, N. Y., electrical apparatus, $3,285; Westinghouse, Church, Kerr & Co., New York, engine, $2,100, $2,200 and $3,068; De La Vergne Refrigerating company, New York, engine, $2,410; Sprague Electric company, New York, electrical apparatus, $2,941.50; New Jersey Foundry and Machine company, New York, electrical apparatus, $3,000.

ELECTRIC RAILWAYS.

The Flushing and South Shore Railroad company has been incorporated with a capital of $150,600 to build 15 miles of road in Queens county, New York.

The Brooklyn Avenue Railway company of Kansas City, it is stated, will change its motive power to electricity. This company operates about seven miles of track.

The Buffalo, Hamburg and Aurora Railway company will open the bids for the construction of its 19½-mile line and the power plant and rolling stock on March 30th at its office in Buffalo.

The Wellston and Jackson Railway company has made application to the City Council of Jackson, O., for a franchise to build an electric railroad and to furnish lights to the city. M. S. Connors is interested in the company.

Work is proceeding uninterruptedly on the power house of the South Side ("Alley L") Elevated Railroad company at State and Fortieth streets, Chicago, and it is expected that current will be sent out on the line by the middle of next month. The greater part of the cars are electrically equipped with the Sprague system.

Three new trolley lines are under contemplation in the vicinity of Allentown, Pa. A line from Allentown to Emaus, six miles long, is to be begun on April 1st. New York capitalists intend to complete the Allentown and Kutztown road of 18 miles, and the Lehigh Valley Traction line will be extended four miles to Coplay and Egypt.

The city electrician of Liverpool, England, has prepared a plan for an important addition to the city electric-lighting system, with the view to providing the current necessary for working and lighting the street cars of the city. A large new generating station is to be established on a site near the Leeds and Liverpool Canal, at a cost of about $750,000. Liverpool will thus have a combined lighting and traction plant.

A Baltimore press dispatch, dated March 13th, states that for the last week or 10 days M. Soulecroup, assistant superintendent of the motive power of the Paris, and a corps of five assistants, have been inspecting the electrical plant of the Baltimore and Ohio railroad. The splendid work being done by the electric motors in the Belt Line Tunnel has attracted attention all through Europe, and M. Soulecroup's visit to this country was for the express purpose of investigating the ways and means of operation. The railroad in question is to be an underground line running from one end of Paris to the center of the city, and it is probable that it will be equipped with electric motors similar to those used on the Baltimore line, except that they will be much smaller.

At a recent meeting of the Chicago City Council a petition was presented by the Chicago Electric Transit company for an ordinance to run trolley lines in the following-named streets for a term of 50 years: In California avenue, between Elston avenue and Lawrence avenue; in Kedzie avenue, between Elston avenue and Lawrence avenue; in Central Park avenue, from Elston avenue and Lawrence avenue. A similar petition from the North Side Electric Street Railway company asked franchises for these streets for trolley cars for 50 years: In Dearborn avenue, between Kinzie and Illinois streets; in Rush street, between Dearborn avenue and Rush street; in Rush street, between Illinois and Ohio streets; in Ohio street, between Rush and St. Clair streets; in St. Clair street, between Indiana and Pearson streets. Neither petition provided for compensation to the city, and both were referred to the committees on streets and alleys.

The volume of traffic on the Metropolitan elevated road during the month of February surpassed expectations, and railroad men find difficulty in explaining the increase not only over the January average but over the December average. The passenger receipts of $93,768.75 indicate that the average number of paid fares a day was 66,942, or the largest in the history of the road. In December, with the holiday shopping, the daily average amounted to 66,600, so that February traffic established a new record, with a gain of over 300. Compared with the traffic in January the increase is 5,295 a day, or eight per cent. The increase in operating expenses to 67 per cent. of passenger earnings may seem less favorable at first sight, but the fact that the Union Loop rental, a large factor in the operating expense, is paid in the month following the period in which it was incurred complicates this question. The voucher paid to the Union Elevated Railroad company last month for January amounted to $13,369, and after deducting 10 per cent of gross receipts in January, for rental proper, the cost of power and maintenance of the loop averages $123 a day. In December the average was $111 a day, but during January power for operation of Metropolitan trains on the loop was furnished by the Union Loop power house for the first time.

TELEPHONE.

The Monroeville, Ohio, Telephone company has been operating its exchange only nine months, yet in that time it has more than doubled its list of subscribers and built 18 miles of pole lines to connect with neighboring towns, besides giving telephonic communication to farmers along the road.

The Marysville (Ohio) Telephone company contemplates the coming summer extending toll lines to nearly every town in the county. The first to be built will be a stretch of 16 miles to Richwood, taking in the villages of Broadway, Harisburg and Magnetic Springs. The line will then probably be extended to Byhalia, on to Mount Victory, where it will intersect the line of Marion, Kenton and Bellefontaine. This will make a very popular line, as almost direct connections can be made to each county seat in the four central counties in the state.

TELEGRAPH.

Apropos of the war excitement, the Telegraph Age notes that old-time war telegraphers are impressed by the fact that, for the first time since the war between the states, the War Department has ordered the use of the cipher code in transmitting dispatches to the various army posts throughout the country.

A recent session of the New Jersey State Senate was taken up in discussing Senator Reed's bill providing that when a telegraph company refuses to pay local taxes assessed upon its poles and wires the latter may be seized and sold. Senator Reed said the present law is such that while the poles and wires may be sold, the property cannot be touched, and the companies snap their fingers at the efforts of the local assessors to reach them. Several senators expressed fear that the bill would apply to railroads, but Mr. Reed assured them that it would not affect railroad, telephone, or electric-light companies. It passed by a vote of 11 to 7.

ELECTRICAL SECURITIES.

The Citizens' Electric Light and Power company of St. Louis has increased its capital stock from $1,500,000 to $2,000,000.

The Metropolitan Street Railway company of New York has declared a quarterly dividend of 1¼ per cent, payable April 15th.

The statement of the Electric Storage Battery company for the year ended December 31, 1897, shows a profit over all operating expenses of $325,290.92. Income from royalties and investments make total net profits of $340,008.99. After deducting interest on bonds the net earnings of the company for the year were $321,808.99. The net surplus was $257,744.42.

The Edison Electric Illuminating company of New York reports gross earnings for February of $256,880, an increase of $4,076, as compared with the same month of last year, and net $134,573, an increase of $16,565. For the two months ended February 28th the gross earnings were $555,188, an increase of $102,085, as compared with the corresponding period of last year, and net $299,962, an increase of $45,411.

A proposition is to be submitted to the stockholders of the Consolidated Traction company of New Jersey on March 28th for the leasing of the company to the North New Jersey Traction company, the latter being a new corporation which has been formed to control many of the surface lines in the northern section of New Jersey. Consolidated New Jersey, which is to be guaranteed a rental on a sliding scale beginning with two per cent. for the first year, earned about 2¼ per cent. on its stock in 1897.

The $5,000,000 capital stock of the Union Elevated Railroad company was placed on the regular list of the Chicago stock exchange last week. This action places all the securities based upon the Union Loop property on the exchange, the $5,000,000 bonds having been listed previously. In the statement to the governing committee the amount of bonds outstanding was put at $4,200,000, indicating that the recent sale of $712,000 by Mr. Yerkes in the East reduced the $1,050,000 generally supposed to be in the hands of the trustee under the mortgage, as a reserve against judgments for damages, to $800,000

MISCELLANEOUS.

The next meeting of the Engineering Association of the South will be held in Nashville, Tenn., on April 14th.

The Self-propelled Traffic association has arranged for trials of heavy-traffic motor vehicles to come off in Liverpool during May next. The Auto-mobile club of France has been invited to send delegates, and it is expected that the prominent officials and members of this club will witness the trials to be given on that occasion.

An ingenious advertisement is being worked in Philadelphia's streets at night. A man drops a lot of small change on the sidewalk and, of course, everybody looks in his direction. Directly after the money is dropped the man presses a button on his coat and there appears in his hat a transparency with electric lights showing the name of a certain play. All the coins have a hole in them through which is fastened a stout thread, and a single jerk of the man's hand recovers every piece.

Consul Jackson at Cognac, France, has reported to the State Department at Washington that the city of Niort proposes to have electric railways and lights for its streets. Manufacturers interested in this subject can obtain information by addressing Monsieur le Maire de la Ville de Niort, Deux-Sevres, France. The consul says there is also a movement on foot to establish a tramway, with the new port, La Pallice, by an electric line 2½ miles long. Communications in regard to the matter should be addressed to Monsieur P. W. Morch, Chamber de Commerce, La Rochelle, France.

The Navy Department, through the bureau of supplies and accounts, is inviting sealed proposals until April 5th for furnishing the Norfolk, Va., navy yard 1,000 electric lamps of 16 candle power; 800 Edison lamps, 32 candle power; 60 pounds fuse wire, 1 to 30 amperes; 50 pounds solder; 10 bottles Yager's soldering scales; 400 pieces cut sheet mica; 400 hard vulcanized fiber washers; 100 Edison fuse plugs; 20 midget two-wire cut-outs, and other supplies. Blank proposals can be obtained upon application to Edwin Stewart, paymaster-general, United States Navy, Washington, D. C.

TRADE NEWS.

The Navy Department has placed a large "rush" order for enclosed arc lamps with the Jandus Electric company of Cleveland.

J. S. Petersen and O. F. Fobes have formed a copartnership to engage in the electrical construction and supply business at Appleton, Wis., under the firm name of Petersen & Fobes.

A very interesting pamphlet devoted to the properties and product of the Illinois Steel company of Chicago has just been issued for distribution. It contains much information of a general character, as well as descriptions of the several departments of the business.

The Western Electric company's fan catalogue for 1898 is an excellent piece of work. Desk and ceiling fan motors for both alternating and direct current are described. The illustrations are very satisfactory. Some of them are full-page, and they supplement the text admirably.

The Michigan Pipe company of Bay City, Mich., is working on an order of 14,685 creosoted tamarack cross-ties for the Denver Consolidated Tramway company. The Denver Consolidated Tramway company purchased 1,600 creosoted ties from the Michigan Pipe company last year, and, after investigating the merits of creosoted ties, has placed this large order for its 1898 improvements.

The Rae Motocycle company of Chicago has been incorporated with a capital stock of $40,000. The officers are: President, Hugh L. Burnham; vice-president, F. B. Rae; secretary, Paul Synnestvedt; treasurer, C. W. Dickerson. The company will manufacture electrically propelled vehicles under Mr. Rae's patents, building the motors and batteries. The Sterling Cycle Works is under contract to build the first equipment—a cab—for the Rae company, and the latter expects to be soon in the market for businesss.

General Sales Agent L. F. Frorup of the Schiff-Jordan company of New York is now taking an extended tour in the eastern and western states, and reports that he finds business of all lines very good, especially the sale of the Ship carbon, the excellence of which for arc lighting is well known to all branches of the electrical trade. Mr. Frorup reports having received contracts for 180,000 of this high grade carbon one day last week. He is an old resident of Chicago, and his hustling abilities have been shown in connection with the Schiff-Jordan company.

Mr. Paul G. Fiedler of Yokohama, Japan, has turned to that country after several weeks' business visit in the United States. Among the agencies which he has secured are those of the S. M. Morgan Smith company of York, Pa., Fort Wayne Electric corporation, Queen & Co. and Chicago Fuse Wire company. In addition, Mr. Fiedler is the principal represen-

ative in Japan of the Jandus Electric company and the Buckeye Electric company of Cleveland, Ohio. Mr. Fiedler is well remembered in the electrical trade as a manufacturer of silk filaments for incandescent lamps in Boston, Mass., in which he was prominently identified until about two years ago. He reports a very successful business thus far and the outlook for the future as exceedingly bright. His many friends will be pleased to hear of his success.

Mr. Edward B. Hatch has been elected president and general manager of the Johns-Pratt company of Hartford, Conn., to succeed the late president, Mr. H. W. Johns. The selection of Mr. Hatch is directly in line with the usual policy of this company in recognizing the ability of its employes. Mr. Hatch has been identified with the concern for over 13 years, beginning at the foot of the ladder, and by diligent work and application he has won the confidence of its stockholders, and has been general manager for some time. He has an extensive acquaintance in all branches of the electrical trade, and his friends will wish him continued success at the head of this large concern. Mr. H. H. Luscomb, who has been elected secretary of the Johns-Pratt company, has been in its employment several years. Vulcabeston, the product which is manufactured by the Johns-Pratt company, is the well-known insulating material.

BUSINESS.

The Hawkeye Telephone Construction company of Des Moines and Chicago has a "local and long-distance telephone" sign which has been indorsed by the Iowa Telephone association. The sign is 17 inches square and is made of enameled iron, the design being in the shape of a Maltese cross.

The Joseph Dixon Crucible company's circular on "Friction and Lubrication" is a carefully prepared essay on the subject. It shows the value of graphite in a convincing manner. Samples of graphite and information are sent to users of lubricants without charge by the company, which is addressed at Jersey City, N. J.

M. H. Reagan, the incandescent-lamp repairer of 178 Green street, Jamaica Plain, Boston, calls attention to the fact that he is operating under a license granted by the lamp manufacturers' association, and thus has full use of the patents controlled by the pool. He guarantees improved methods and satisfactory results.

The tried and reliable P. & B. insulating products of the Standard Paint company of New York are reported to be in greater demand than ever. These goods—the insulating compound, insulating tape, armature and field-coil varnish and ruberoid motor cloth—have stood the test of years with credit, and deserve their success.

The demand for a dynamo brush which can meet the requirements of engineers has been one of the problems in the electrical trade, and it would seem, from reports, that the K. & W. company of Pittsfield, Mass., has overcome the difficulties in this regard. This company reports that its business in this department has increased greatly during the last two months, and it shows a large number of letters from prominent users, who speak in the highest terms of the K. & W. dynamo brush. It is also pleased with the flattering demand for its Hardy incandescent lamp, which is proving very popular with the trade where sustained candle power is considered.

The Davis & Egan Machine Tool company of Cincinnati, Ohio, reports that its already large foreign business is steadily increasing. It received last week, through its store at London, England, orders from C. & D. Peters & Co., at Moorgate, England, for a number of heavy screw machines and milling machines; also a large duplicate order from Fraser & Chalmers of Erith, England, consisting of engine lathes, chucking lathes, radial drills and boring mills. Through the company's office at Berlin, Germany, it received an order from a concern at Stettin, Germany, for an outfit of bicycle machinery, including hub machines, screw machines, pedal machines and sprocket milling machines.

The E. W. Bliss company, the well-known manufacturer of presses, dies and special machinery, of Brooklyn, N. Y., reports an unusually large demand for tools of its manufacture, especially those adapted for electrical work. For this purpose the company manufactures a large line of machines for blanking and notching armature core disks and sections, as well as for making other parts of electrical machines. Included in this list is a very large number of double-crank presses, from the smallest up to the largest size. In connection with electrical work the Bliss company calls special attention to its improved automatic notching press for disks of all diameters. Those who have used this machine declare it to be the best tool on the market for its specific work, and the manufacturers will be pleased to correspond with those who are interested regarding it.

The Western Electric company invites attention to the Lakon transformer, the Star soldering stick and the Simplex friction tape. A sample of the tape will be sent free of expense to anyone interested. Writing of the transformers, the Missouri Valley Electric Light company states that it has had a number of them in circuit for two years, and that they have given excellent service. The manufacturers of the Lakon transformers are pioneers in their trade. They have recently completed a large three-story brick factory, which is equipped with the best facilities to enable them to manufacture transformers to the best possible advantage. Their laboratory is most complete, being fitted up with a full complement of instruments with which to make exhaustive transformer tests, and thus they are assured of the quality of the transformers before they are shipped to purchasers.

The Mica Insulator company, whose offices are at New York and Chicago, with a branch at London, England, recently received from one of the large builders of electrical machinery orders for over 5,000 Micanite segments of a large pattern (many of the segments being more than 17 inches in length), and from another leading manufacturer of electrical apparatus an order for 2,000 segments; also from one of the leading motor builders an order for 26,000 segments. This volume of business would indicate that the company's Micanite segments are meeting with favor among machinery builders. The company claims that its segments are softer and wear down more evenly than mica segments. Therefore they are said to give better satisfaction. A sample set of segments for any one of the smaller machines will be furnished free of expense to electrical manufacturers or repair concerns which are desirous of demonstrating the value of the segments.

The Clonbrock Steam Boiler company of Brooklyn, N. Y., recently closed an order for boilers of 500 horse power capacity for the Coney Island and Brooklyn Railroad company. These will be installed at the station located at Smith and Ninth streets, Brooklyn, and will make a total of 2,300 horse power of the Morrin Climax boilers at this location. The Clonbrock company has also received an order from the same company for 500 horse power to be located at the DeKalb avenue station, where it has already 2,100 horse power in operation. These orders were in the open market for some time, and, after close investigation into the merits of the various boilers which were offered, the order was given to the Clonbrock company. The L. Candee company of New Haven has placed an order for 1,000 horse power with the Clonbrock Steam Boiler company, for immediate delivery. General Manager S. V. Morrin reports that his company is enjoying a large business, and that the prospects in its line of trade are exceedingly bright, as it has more prospective work ahead at present than it has had for many months. The Climax boiler has a national reputation, and is nowhere better known than in the electrical and street-railway fields. The economy with which this boiler can be run, and especially in places where small space can be utilized, presents a strong argument in its favor. The Clonbrock company has recently issued a new catalogue which is full of interesting information about boilers.

ILLUSTRATED ELECTRICAL PATENT RECORD.

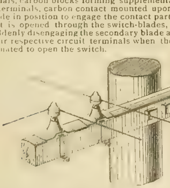
Issued March 15, 1898

600,509. Controller for Electrically Propelled Vehicles. Reginald T. D. Brougham and Walter C. Bersey, London, England. Application filed December 13, 1897.

Connection is established between the foot and switch levers so that the first movement of the former causes a rapid and wide separation of the contacts, and another connection between the foot-lever and brake-lever enables the movement of the former gradually to operate the latter

600,523. Quick-break Electric Switch. Thomas E. Drohan, Chicago, Ill. Application filed November 13, 1897.

A main and a secondary contact blade are pivotally mounted and adapted to close the circuit between the terminals, carbon blocks forming supplemental contact parts or terminals, carbon contact mounted upon the secondary blade in position to engage the contact parts after the circuit is opened through the switch-blades, and means for suddenly disengaging the secondary blade and contact from their respective circuit terminals when the main blade is actuated to open the switch.



NO. 600,607.

600,527. Depressible-rail System for Electric Railways. William Grunow, Jr., Bridgeport, Conn. Application filed April 12, 1897.

An electrical contact system consisting of contact receptacles having a tubular projection formed in the cover thereof and being provided with a mercury receiver, connections between the receiver and source of electrical supply, a sleeve movably mounted in the tubular projection and having outwardly directed arms, springs supporting the arms, a contact device carried by the sleeve and a depressible rail connected with the contact device.

600,607. Insulator Support for Electrical Conductors. Fred Benedict, Niles, Mich. Application filed September 13, 1897.

An arm is employed for suspending an electrical conductor, a strap to embrace the support and means for clamping the strap thereto, a bolt carried by the strap and an insulator carried by the bolt.

600,616. Alternating-current Meter. Georg Hummel, Munich, Germany. Application filed October 30, 1897. Patented in Hungary December 13, 1895; in Switzerland January 2, 1896; in England January 8, 1896; in Italy February 17, 1896; in France April 20, 1896; in Spain April 26, 1896, and in Austria July 10, 1896.

This is an alternating-current meter of the motor type, in which the combination of an auxiliarly wound electro-magnetic core of a general U or horseshoe shape is combined with main windings laid in grooves or holes, in the electro-magnetic core, means whereby the proper phase displacements may be obtained, and a moving part under the influence of the electro-magnetic core for indicating the passage of current through the windings.

600,633. Trolley. John Clayton, Cuyahoga Falls, Ohio. Application filed November 4, 1896.

The head sections are adapted for connection to the trolley pole; hollow bearing sections are connected to the head sections and adapted to contain the lubricant and extending inwardly, having their inner edges meeting, each bearing section being provided with a lubricating opening, and a trolley wheel mounted to turn on the bearing sections.

600,693. Method of Making Soluble Metal Electrodes for Accumulators. Jules Julien, Brussels, Belgium. Application filed September 26, 1896. Patented in Belgium March 10, 1896; in Germany March 18, 1896; in France April 1, 1896; in England April 2, 1896; in Austria April 25, 1896, and in Hungary April 27, 1896.

The process of producing a soluble electrode for use in secondary batteries consists in depositing on a copper plate, by electrolysis a finely-porous surface of pure copper, then amalgamating the copper surface so produced, and finally depositing on the amalgamated surface a coating of zinc to form the active surface of the electrode.

600,719. Galvanic Battery. Emil Habermann, Michigan City, Ind. Application filed October 7, 1897.

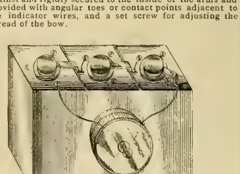
A wick is disposed between and in contact with both elements, and an exciting fluid is isolated from the elements and a portion of the wick is immersed.

600,743. Automatic Safety Circuit Closer and Cut-out. Walter L. Pratt, Adams, N. Y. Application filed May 13, 1896.

The device comprises hinged arms, carrying loop connections, the arms being held normally in circuit by a fuse wire, a plate through which the current passes, and which acts as a magnet, a pivoted armature mounted upon the plate, and a needle or pointer also pivoted upon the plate co-operating with the fuse wire.

600,765. Automatic Fire Alarm. Robert J. Baker, Baltimore, Md. Application filed April 28, 1897.

A thermostat, comprising an insulated iron bow in contact with the battery wire and having outwardly projected arms extending toward the indicator wires, parallel with the battery wires, bars of different expansibility lying against and rigidly secured to the inside of the arms and provided with angular toes or contact points adjacent to the indicator wires, and a set screw for adjusting the spread of the bow.



NO. 600,850.

600,850. Primary Battery. J. Ensign Fuller, New York, N. Y. Application filed April 5, 1897.

A battery casing is provided with vertical partitions whereby separate chambers are formed therein, and divided by transverse partition plates whereby separate cells and storage compartments are formed, the cells being closed at one end by the transverse partition plates and at the other by plates to which carbons or poles are secured, the carbons being provided with side openings and also with central openings through which are passed the zincs, and the transverse partition plates being provided with ports or passages, and means for opening and closing the same consisting of shafts which pass through the bottoms of the compartments and are provided with valves at their inner ends.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, APRIL 2, 1898. No. 14

Electrolytic Work at Niagara Falls.

By Orrin E. Dunlap.

The Mathieson Alkali Works at Niagara Falls occupy about the largest plot of ground on the Niagara Falls Power company's property yet leased for an electrolytic industry, and the buildings are most substantially built of brick, a fence surrounding the entire plot. Both in the front and at the rear the Niagara Junction railway affords excellent receiving and shipping facilities. This company also has a plant in Saltville, Va., and offices in New York and Providence, R. I. The president of the company is Edward E. Arnold.

The Castner electrolytic process is used to make caustic soda and bleaching powder. The raw material used is common salt, which is dissolved and fed into the cells built of slate slabs. The current enters at the carbon terminal or anode and carries the metallic sodium with it to the mercury cathode, there uniting with the mercury, and forming an amalgam. At the carbon terminal the other element of the raw material, chlorine, is liberated and drawn off by an exhauster which is driven by electricity. The cell is built to rock, and has three divisions or compartments, the outer two being similar, while the one in the center is different. The anode is formed by the amalgam and mercury, and the cathode by an iron grid. Water is supplied to this compartment the current causes it to unite with the sodium of the amalgam, thus forming sodium hydrate or caustic soda. The air carries off the liberated hydrogen. Large kettles receive the caustic liquor, and the water is disposed of by heating, leaving the caustic solid and beautifully white. Lead chambers, having their bottoms covered with layers of slacked lime about four inches deep, receive the chlorine gas, and sponge-like the lime absorbs the gas, charging it to the extent of nearly 40 per cent.

The electrical room of the Mathieson company's Niagara plant (Fig. 1) is one of the finest at the Falls. The floor is of wood, the walls are white, and the light comes from skylights. The dimensions of the room are 125 by 40 feet. Its position in the plant is to the north of the cell room. In this room are installed the static transformers, the rotaries and the switchboards. In all there are 31 rotaries, each capable of converting about 200 horse power from about 120 volts alternating to 200 volts direct current. The rotaries are placed on the south side of the room, and the static transformers and the switchboards on the north side, the installation in its entirety presenting a most attractive appearance. It converts 2,000 horse power at a voltage of 2,200 at 25 cycles to direct current having a voltage of about 200. On passing through the cell room one notices that the rows of the cells are uniform and run from north to south, being connected up in sets.

On the switchboards are mounted the instruments, controllers, field rheostats, fuse boxes and main primary switches. The controllers afford a range of 100 volts on the direct-current side of the rotaries, thus providing means for keeping the voltage proportional to the cells in use. By cutting in or out sections of the primaries of the static transformers, the controllers easily serve to vary the pressure to the rotaries. The static transformers are shown in the illustration which is presented on this page, as they are located in the rear of the switchboard. Each set of these transformers consists of two machines of 100 horse power, and reduces the voltage from 2,200, as supplied by the Niagara Falls Power company, to from about 170 to 300 volts. To the rear of the rotaries, on the south wall, are located the main switches and circuit breakers.

In addition to the electrical apparatus described the plant has 20 two-phase induction motors, which are used for various purposes, to furnish power in the machine room, drive blowers, operate pumps and cranes.

The exterior view of the plant (Fig. 2) presented on page 194 shows it from the west side. The two-story building to the left is the office building. It will be observed that the majority of the buildings are low and lighted from the top.

FIG. 1. ELECTROLYTIC WORK AT NIAGARA FALLS.—TRANSFORMER ROOM

A Flood Causes Acetylene Explosions.

A curious accident was reported from Dayton, O., last week, in which water caused a fire. The Craig-Reynolds shops in North Dayton were flooded with 10 feet of water, which reached some packages of carbide of calcium. This formed acetylene gas, causing several explosions and a fierce blaze. The Fire Department had to fight the flames from boats. The damage was $10,000.

Northwestern Electrical Association.

Official announcement has been issued by Thomas R. Mercein, secretary of the Northwestern Electrical association, that the steamer Northwest has been secured for the summer meeting of that organization. Passage can only be secured by invitation cards issued by the secretary, as it is not proposed to make this a general excursion, but retain the electrical character of the company. Mr. Mercein says:

Invitation cards are issued in the name of persons invited are not transferable, and are issued from this office only. A request for one will be considered a guarantee that the person for whom it is asked will accept it and pay his own steamer transportation to Duluth on or before May 25th; persons intending to take the trip must send their invitation card to the secretary, with check or money order for $15 for each person, drawn in favor of the association covering the steamer transportation referred to. Receipts will be sent and name forwarded to steamer committee for proper assignment of which due notice will be sent to applicant. Other modes of general information I. M. Hill, W. W. Dodd or I. L. Peaslee have been appointed a special committee without any arrangements. For general information in connection with the entertainment of the ladies' part of that committee, I. M. Hill, 164 Monadnock Block, Chicago, Illinois.

G. H. Simons contemplates putting in an electric light plant for Canby, Minn.

New York Exposition Notes.

Mr. Fred Catlin, the manager of the telegraphic tournament at the electrical exposition in New York next month, has completed the preliminary arrangements for that contest, and has arranged the classes. Circulars on the subject are ready for general distribution, and there is already a great demand for information on the subject from all parts of the country. Mr. Catlin informs the exhibition management that the entries will probably be more numerous than at any other tournament that has occurred, and thinks that some of the records will be phenomenal. It is proposed, in addition to the regular contest, to have interesting exhibits of telegraphic skill in novel directions. Mr. Jesse H. Bunnell, the electrical manufacturer and veteran operator, is taking a deep interest in the contest, and has volunteered to equip the whole stage with the necessary apparatus for the competition in the shape of keys, sounders, batteries and auxiliary appliances. Mr. Bunnell is desirous to have a separate prize offered for an "old-timers' class," and has already entered himself for that contest. He has the reputation, dating from the war, of being an unusually fast and skillful operator.

Mr. H. V. Parsell, the well-known banker of New York, who has long been interested in electric-deposition work, has kindly placed in the hands of his son, Mr. H. V. Parsell, Jr., the electrical engineer, for exhibition at Madison Square Garden during May, a marvelous collection of galvanoplastic work, done during a long series of years. It may be doubted whether any other amateur could possibly show anything approaching this remarkable collection in beauty and interest. It will not only include several striking pieces, as large as 25 inches by 25, and reproducing celebrated works of art and famous men, but will comprise large numbers of coins, medals and fac-similes of antique gems. The most extraordinary part of this beautiful collection, however, will be that which embraces the reproductions from natural objects. There are, for instance, snakes and frogs which have been made on the bias and from the life. The snake is etherized under a bell jar, then taken out and greased with sweet oil and replaced in the bell jar, while a sufficiency of thin plaster is mixed with warm water. The snake is then placed on a glass plate and posed. Around him is built an enclosure of four square bars, and the plaster is slowly poured over the snake, the bars confining the cast in a rectangular shape. When the plaster is hard it is freed from the sticks and glass plate and the now defunct reptile is carefully removed, tail first, from his intaglio impression. The plaster cast thus obtained is rendered waterproof by immersion in melted paraffine. A metallic-conducting surface must now be given to the interior of the cast. This is done by moistening the surface of the mold with a solution of silver nitrate and by exposure to sulphuretted hydrogen precipitating the silver on the cast. Conducting wires are now fastened around the edge, and the mold is carefully suspended in the depositing bath. A good firm coating takes about three days to form, and then the mold is softened in boiling water, and carefully broken off.

People have often heard of the incinerating effects of high-frequency currents, but rarely get any prac

tical demonstration. Mr. George P. Low, the well-known electrical engineer of San Francisco, has preserved the remains of two eagles, some storks and other birds, which had short-circuited part of the current of a California transmission line while sitting on the wires, with the result of leaving only their beaks and talons, not a vestige of the bodies or feathers being discovered. Mr. Low is forwarding these curious relics to the electrical exhibition, where they will be mounted in such a position as to show how the thing happened, and just what happened. It will be the first exhibition of the kind that has been made.

It is proposed at the exhibition to have, among other railway apparatus, a working model of track

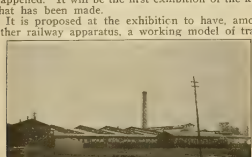


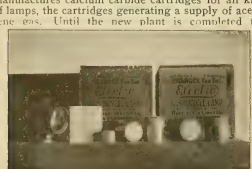
FIG. 2. ELECTROLYTIC WORK AT NIAGARA FALLS.—EXTERIOR VIEW OF MATHIESON ALKALI PLANT.

intended to demonstrate the operation of the third-rail system as applied to steam railroads. Colonel N. H. Heft, the electrical engineer of the New York, New Haven and Hartford Railway company, whose work is so widely known in connection with the successful third-rail line between Hartford and New Britain, Conn., has very kindly placed at the disposal of the management blue prints showing the construction of the track, and some of the actual material used. The model track, from 50 to 100 feet long, single and double, and about five inches gauge, is now being constructed on Col. Heft's plans, and will be shown in actual operation during the continuance of the show, the details of the track being imitated as closely as the conditions will allow. Over this track a train of cars will run to and fro continually, showing how the current is picked up and delivered to the motor, and how the switches and signals are included in the operation.

Acetylene for Portable Lamps.

One of the earliest forms in which it was proposed to utilize acetylene was in bicycle lamps and small hand-lamps, as well as those of ornamental design, but owing to the stock-jobbing schemes which the promoters of the industry indulged in the commercial development of acetylene for portable lamps was practically neglected. Now, however, this enterprise is being seriously considered, according to the Niagara Falls correspondent of the Western Electrician, who furnishes the following interesting narrative of the development and plans of the projectors:

"The new factory building of the Buffington Light company is going up rapidly at Niagara Falls. It will be a frame structure 100 by 40 feet at the foundation and two stories high, located on the Niagara Falls Power company's property, adjoining the plant of the Acetylene Light, Heat and Power company on the east. The Buffington company manufactures calcium carbide cartridges for all kind of lamps, the cartridges generating a supply of acetylene gas. Until the new plant is completed the



ACETYLENE FOR PORTABLE LAMPS.

Buffington people are trying to meet the demand for their goods in a small building in the power district. The forms for the cartridges are now made in New York, but when the new plant is in operation they will be made at the Falls. The manager of the Niagara Falls works is H. A. Brognard. The company has a capital stock of $300,000, and is allied to the Electrogas company, which company claims to control the patents on carbide.

"The business of the Buffington Light company marks a new departure in the use of acetylene, or rather in the manner of its application. Men interested in carbide have long predicted great things for it, but its use in lamps for household and other purposes has until recently been more of a fanciful nature than a reality. It is now claimed that the cartridges of the Buffington company make the use of acetylene in lamps clean, simple, practical, without smoke, while giving out a powerful clear white light. In its application the use of carbide is very easy in handling, for to refill a lamp means the simple insertion of a fresh cartridge in place of the one consumed, a process requiring but a moment of time without soiling the hands or clothing.

"At present the company is making three sizes of cartridges. One for bicycle lamps, and Nos. 8 and 12 for table and student lamps. In the accompanying illustration the comparative sizes of these cartridges is portrayed faithfully. First to the left is seen an Electro bicycle lamp, and next to it a box in which 12 bicycle cartridges are packed. Next comes one of the bicycle-lamp cartridges; next two No. 8 cartridges, and then two No. 12 cartridges. The cases in the background hold one gross of bicycle-lamp cartridges, or 12 of the smaller boxes next to the lamp.

"All the cartridges are made in two parts, one sliding over the other to allow for expansion. When the consumed cartridge is removed from the lamp it is always found in its extended form, the residue occupying more space than the original carbide. The cartridge used in bicycle lamps is about 1⅝ inches in diameter by 1¼ inches deep. The carbide with which it is filled is about the size of wheat, and will furnish a supply of gas sufficient to last 3½ to four hours. Both the top and the bottom of the box are perforated, the top being distinguished from the bottom by a large hole in the center. The interior is supplied with an absorbent, the bottom being covered, four divisions being created with a white absorbent, while a blue absorbent is placed at the top, thus furnishing an additional means of distinguishing between the two ends. In charging the lamp the water valve is closed tight, the water chamber is filled with clean water; the charge is placed on the bottom of the lamp with a spring over it, and then the two parts of the lamp are fastened together on very much the same principle as an oil lantern. To start the lamp the water valve is opened by turning a finger-piece to the left, and in a few seconds gas will generate and the flame will light by simply holding a lighted match to the opening of the chimney at the top of the reflector. The proper height for the flame is about half an inch. The light will not jolt out, as is the common cause of regret among wheelmen over their oil lamps, but when it is desired to put it out the valve should be closed some minutes before the time it is desired to extinguish it, so as to shut off the water and stop the generation of gas. The light will go out as soon as the gas remaining in the chamber is consumed. The size of the flame is regulated by the valve-screw which governs the flow of water. If the flame blows it is good evidence that water is flowing on the carbide too freely, and, on the other hand, if the flame grows dim, it may be taken as a sign that more water should be allowed to reach the carbide. The manufacturers state that none of the cartridges will generate a sufficient amount of gas to explode the lamps in which they are used. The place to attach the lamp to the bicycle frame is preferably to the head, just below the handle bars. It should be in a perpendicular position, not inclined forward, as its reflector is designed to throw the light in front of the wheel.

"Cartridges Nos. 8 and 12 are also made of t.n. No. 8 is filled with carbide about the size of corn and No. 12 about the same size or a little larger. Both have a perforated standard in the center. No. 8 will give a supply of gas for four to five hours, while No. 12 will last seven to 7½ hours. No. 8 will use about 12 ounces of water, and No. 12 about 16 ounces in throwing off its gas. The time given as the life of the cartridges while in use is considered in connection with a half-foot burner. The size on an Electro gas lamp indicates the size of cartridge it requires.

"It is evident that the lamps may have many forms, and it is possible that in the future the company will develop some novel styles. The Niagara plant will be equipped with the necessary machinery to make the cartridge boxes and necessary parts. As it is located near the Acetylene Light, Heat and Power plant, it will be in close touch with a supply of carbide. An electric motor of small size will be installed to operate a grinding machine."

Fribourg Accumulator Plant.

The town of Fribourg, Switzerland, which lies on the Sarine River, has a water power remarkable for its constancy, and the people have not been slow to avail themselves of it for supplying the town with water, railway privileges and electric illumination. The normal output of the stream was entirely exhausted when the railway was supplied, and as more power was required recourse was had to the storage battery.

In the present plant there are three turbines moving under a head of 10 meters, the first turbine of 500 horse power actuating two generators of the Thury type of 500 amperes at 350 volts each. Current is delivered at 300 volts to many commercial motors which take over six horse power, and to

FIG. 1. FRIBOURG ACCUMULATOR PLANT.—GENERAL VIEW.

the street-car lines, which consume 60 horse power for each two cars in motion. A second turbine of 300 horse power is direct-connected to two Thury dynamos of 500 amperes at 150 volts each, for feeding the electric lights and operating motors of less than six horse power. These dynamos also supply suburban customers above Fribourg proper. They are also utilized to charge the accumulators which supply the lighting circuits in the remote sections of the town. Finally, several motors of from seven to 30 horse power receive current from these generators while the batteries are being charged during the daytime. The third turbine, also of 300 horse power, actuates the water works pumps, raising the public water to a height of 150 meters above the river.

The accumulator equipment is in the basements of the old Hotel de Ville (Fig. 2). To this point the lines from the dynamos are brought, and from here the six feeders of the urban system issue. These basement rooms are particularly well situated for the purpose. The batteries installed are of the German-Swiss type.

The principal advantages claimed for these batteries, aside from their cheapness, are their light weight and their solidity, resulting from the mode of construction. Each plate, whether positive or negative, is inclosed in a perforated celluloid frame. The active material is thus forcibly held in the lead grid, which is the skeleton of the plate. Again, it is claimed the celluloid serves to strengthen the plate and prevent injury through mechanical forces, while permitting of large latitude in quick charging and discharging.

The installation includes two batteries of 83 elements each, and of 2,600 ampere-hours capacity, at a rate of 130 amperes, or one ampere per kilogramme of plate. This capacity descends to 2,000 ampere-hours for a discharge of 200 amperes, and to 1,400

ampere-hours at a 400-ampere rate. These capacities have been calculated for a fall of tension of 10 per cent.

The normal intensity of the charging current is 200 to 250 amperes and the maximum 350 amperes. While charging the mean potential of each element is 2.3 volts and in discharging it is about 1.96 volts.

Each element is made up of 50 plates, 250 millimeters long by 200 millimeters wide, in glass cells; 24 positive and 26 negative electrodes. The weight of a positive plate is 2.8 kilogrammes, and of a negative 2.5 kilogrammes, so that the entire weight of an element rises to 138 kilogrammes, including the soldering and connections.

The plates are held apart by projections of celluloid attached to the case of the same material which surrounds the plates. The electrodes, both positive and negative, are supported by two plates of glass which stand edgewise on the bottom of the cell and hold the plates by lugs of lead.

Each cell rests in oil insulation, upon wood, this being further separated from earth by oil insulators.

The acid used has a density of 23 degrees Baumé, each cell containing about 50 liters. The two cells constituting one element are connected by a glass syphon, so that the density of the two parts of the element shall remain always the same.

The tension required at the distribution board is constant up to the end of the discharge. The current required can never surpass 175 volts, while all the cells can furnish at least 246 volts.

Fig. 3 shows a combination for charging composed of a motor of 50 horse power at 300 volts, mounted on the same shaft and the same base as two generators of 25 horse power each, producing a continuous constant current of from 30 to 80 volts. The motor is of the Lundell type, of six poles, with but one exciting coil, while the generators have four poles and four exciting coils. The three drum armatures have toothed cores, with the Alioth winding. This combination makes 800 turns per minute. Automatic circuit breakers guard against a possible discharge backward from the accumulators. These, of which there are four, are made up of an electro-magnet of the horseshoe pattern and two coils. One of these coils, provided with a large wire winding, is traversed by the charging current, and eventually by the return current from the battery. The other spool, wound with fine wire, is constantly excited by an independent current, and, according to requirements, connects or disconnects the apparatus.

When the charging current flows through the circuit breaker the magnetic attraction exercised by the magnet is the sum of the attraction set up by the two spools. But if for any cause the battery current backs up through the coil, the spring overcomes the little remaining attraction, when the armature is released, and by proper attachments opens the circuit.

All the accessories are mounted upon four distribution tables (Fig. 1). The first comprises the apparatus pertaining to charging, the second that utilized in the discharge, and the others to the automatic regulators of the batteries. These automatic regulators work on the relay principle, and actuate a commutator automatically.

Several Pittsburg traction companies have combined for the purpose of erecting and maintaining a storage battery plant which will supply current to the trolley systems entering into the agreement. This scheme has many attractive features that should prove applicable wherever large trolley systems are operated.

Electrical Equipment of Plating Plants.

By C. F. Burgess.

Although the electro-deposition of metals existed before the advent of the dynamo, and was in fact one of the first uses to which the dynamo was put, it is noticeable that this branch of electrical industry has not shared the rapid improvement and development of later years that is so marked in other electrical industries.

The extent and importance of the electro-plating industry in this country may be hard to estimate, but figures which were given some time ago gave the number of plating plants of some considerable size as 392, with a total capital of $38,000,000 and an annual output worth $3,400,000. These figures do not include the plants devoted to the galvano-plastic arts and the small equipments which are operated in connection with many manufacturing concerns.

The deposition of metals by means of electricity for ornamental and protective purposes has by no means reached its ultimate development, for, aside from the increasing use of coatings of copper and nickel, the so-called galvanizing of iron by dipping into a molten bath promises to be replaced by electro-deposition of zinc from an aqueous solution, owing to the many advantages which such a process has over the old method.

It may seem strange, then, that this electrical industry is one almost entirely neglected by the electrical engineer. The problems which arise here are largely of a chemical and of an electrical nature, but it is very seldom that a practical plater thoroughly understands the laws of electricity, and even less common to find one who may be called a chemist.

There are a number of reasons for this state of affairs. In the early days of plating the greatest possible secrecy was maintained among those engaged in the work to prevent processes and improvements from becoming generally known. This tendency still exists at the present time, and many of these plants exclude visitors on this ground, although it may be said to be secrecy without any secrets. Such a condition has a tendency to prevent the general knowledge of new processes and ideas which may be used.

There are very few plating equipments which cannot be criticized from the electrical standpoint. The dynamos are usually small shunt-wound machines, without regulating devices, or with unsatisfactory ones. The commutators are smaller than they should be, and, owing to the very large currents carried, the sparking is very destructive. Such a machine will give a high voltage at light loads (when there is little work in the tanks), when a lower voltage is desirable. Owing to the armature reactions and the armature drop, caused by the large current, the voltage drops rapidly when there is a considerable demand for current and when a higher voltage is desirable to compensate for losses in other parts of the circuits. Various regulating devices have been used, such as a rheostat in the field circuit and plugging arrangements for cutting in and out portions of the turns on the field windings. Such machines do not automatically take care of the variations caused by varying current, and require constant hand regulation and attention.

In choosing a dynamo for a plating plant, considerable difficulty may be experienced in determining what size of machine to use, owing to the unsatisfactory methods which manufacturers use in rating the machines. The dynamos are usually rated as capable of supplying current to a given number of gallons of solution. This is a very uncertain way of giving the current capacity of the machines, for the current density in one solution may be greater than should be used in another solution, and, in addition, the current which a plating tank of a given current content will require, when full of work, depends upon the shape of the tank and the relative position of the electrodes. To obviate the former difficulty, it is customary to rate a machine in its capacity to supply current for a given number of gallons of copper solution, another number of gallons of nickel, and still another for silver. The second difficulty still leaves the purchaser in the dark as to what size of dynamo to order. A cyanide of copper solution will allow of a current density being used which is small, three or four amperes per square foot of cathode surface, while in a copper sulphate bath the current density may be increased to 40 amperes per square foot, so that the size of dynamo to be used for a given amount of solution depends not only on the metal to be deposited, but also on the nature of the solution.

A much more satisfactory method would be to use the method of rating which the manufacturers of other classes of electrical machinery adopt, giving the capacity in watts, or, perhaps better, in am-

FIG. 3. FRIBOURG ACCUMULATOR PLANT. -MOTOR AND GENERATORS.

FIG. 2. FRIBOURG ACCUMULATOR PLANT. -BATTERY ROOM.

peres. A plater may then, by his knowledge of the current density which he can use, and the amount of material which he wishes to plate, readily choose the machine which will do his work.

From the considerable demand which exists for a good plating dynamo, a number of the representative manufacturers have lately taken up the question, and are placing on the market very satisfactory machines. They are usually shunt machines, operated at five to six volts pressure. The design of such machines involves some questions which do not arise in the design of those to be used at a higher pressure. The low voltage makes the question of field excitation somewhat difficult. Large commutators, large brush-bearing surfaces and the use of copper brushes are necessary to avoid the heating and destructive sparking caused by the excessively large amounts of current which they are called upon to

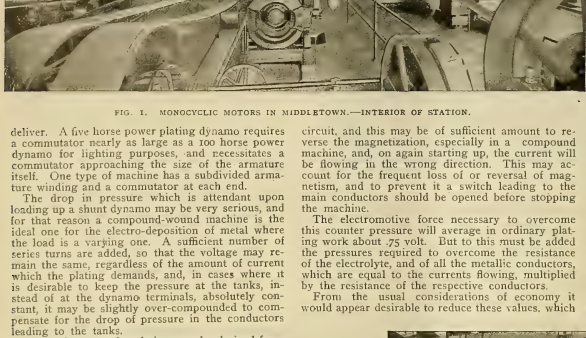


FIG. 1. MONOCYCLIC MOTORS IN MIDDLETOWN.—INTERIOR OF STATION.

deliver. A five horse power plating dynamo requires a commutator nearly as large as a 100 horse power dynamo for lighting purposes, and necessitates a commutator approaching the size of the armature itself. One type of machine has a subdivided armature winding and a commutator at each end.

The drop in pressure which is attendant upon loading up a shunt dynamo may be very serious, and for that reason a compound-wound machine is the ideal one for the electro-deposition of metal where the load is a varying one. A sufficient number of series turns are added, so that the voltage may remain the same, regardless of the amount of current which the plating demands, and, in cases where it is desirable to keep the pressure at the tanks, instead of at the dynamo terminals, absolutely constant, it may be slightly over-compounded to compensate for the drop of pressure in the conductors leading to the tanks.

Where the power for plating may be derived from direct power or lighting circuits, the most desirable arrangement is a motor-dynamo, in which the fields of the dynamo, or low-pressure end, are excited directly from the high-pressure mains. In this case, compounding would not be necessary, for the armature reactions and losses would not have an equal effect in lowering the voltage that would exist in an ordinary shunt machine, and, if desirable, a field rheostat would enable the voltage to be maintained at any desired value.

The consumption of electrical energy delivered by the plating dynamo is expended in overcoming the resistance of the conductors leading to the tanks, the rheostats for regulating the current in the separate tanks, the anode and cathode supports, the resistance of the electrolyte, and finally in the actual energy required for the deposition. The amount of energy required to deposit a metal out of an electrolyte, in which metal goes into solution at the anode as rapidly as it is removed from the solution at the cathode, is theoretically a very small amount, for as the chemical nature of the solution remains the same, there is no change in the chemical energy and consequently no demand for the electrical energy. If an insoluble anode is used, the chemical nature of the electrolyte will change, the solution will become "stripped" of metal, which chemical change necessitates the consumption of electrical energy. If the anode does not supply metal to the solution rapidly enough, which will occur if such surface is too small in comparison with the surface to be plated, not only does the solution become weaker, but a larger consumption of energy or a higher electromotive force is needed.

As a matter of fact, the energy necessary for the deposition from a solution which remains constant is quite an appreciable amount. This is due to the fact that the solution in the neighborhood of the cathode becomes deficient in metal, while in the vicinity of the anode it is more dense, thus setting up an electromotive force and forming what is known as a concentration cell. If the current density is great enough to produce liberation of gases, hydrogen at the cathode and oxygen at the anode, this electromotive force is further augmented. This electromotive force, ordinarily termed the counter electromotive force of polarization, is in opposition to the electromotive force applied at the tank terminals, and consequently a pressure high enough to overcome this polarization must be applied before the current will flow. The amount of this counter pressure may vary between a small fraction of a volt to over one volt, depending upon the current density, character of solution, and whether the solution is agitated. A circulation of the electrolyte will, of course, tend to keep the liquid uniform throughout and tend to remove the gases which are liberated at the metal surfaces. In copper refining this value is about .02 volt, and in ordinary nickel-plating bath it may vary between .5 and one volt. This pressure may be measured fairly accurately by connecting a voltmeter between the electrodes, and then suddenly interrupting the current which is flowing through the tank, and immediately taking the voltmeter reading.

This counter pressure will, of course, send a current in the wrong direction through a dynamo when it is stopped without opening the external circuit, and this may be of sufficient amount to reverse the magnetization, especially in a compound machine, and, on again starting up, the current will be flowing in the wrong direction. This may account for the frequent loss of or reversal of magnetism, and to prevent it a switch leading to the main conductors should be opened before stopping the machine.

The electromotive force necessary to overcome this counter pressure will average in ordinary plating work about .75 volt. But to this must be added the pressures required to overcome the resistance of the electrolyte, and of all the metallic conductors, which are equal to the currents flowing, multiplied by the resistance of the respective conductors.

From the usual considerations of economy it would appear desirable to reduce these values, which can be done only by reducing the resistance of the various conductors. The resistance of the solution may be diminished by using concentrated solutions or by the addition of common salt or some similar chemical compound, which will aid in the conductivity but which will not take part in the chemical reactions. The resistance of metallic conductors would be made small by the well-known method of using copper of generous cross-section. The ordinary voltage of the plating dynamo may be taken as five volts, which, as compared with .75 volt, would give an energy efficiency of 15 per cent., or, allowing two volts between electrodes, as that which is necessary to overcome electrolyte resistance and counter electromotive force, 60 per cent. of the energy is seen to be lost in the conductors and rheostats. The method for saving this energy would be to reduce the voltage of the dynamo and use large copper conductors. A question of electrical design enters here, and makes it difficult to get a dynamo to operate satisfactorily and efficiently on a very low voltage; also, when a number of different plating solutions are used, different voltages are necessary and the dynamo must operate at the highest pressure required. This, then, makes the efficient consumption of electrical energy in a plating room out of the question.

The cost of power consumed, even under present inefficient methods, in a plating plant, not including that for grinding and polishing, is a very small percentage of the value of the product, and considerable economy of power may be sacrificed in order to turn out work rapidly. Where different solutions are operated, requiring different voltages, it is self-evident that power which is equal to the current of each tank multiplied by the difference between the voltage which it requires and that of the dynamo must be absorbed in the conductors and rheostat leading to the tank. A saving of power would be effected by placing two or more of the tanks in series, instead of the usual multiple arrangement, but to do so would require an equivalent amount of work in each tank, so that this complication would far outweigh the advantages derived.

Next to the dynamo, the most important piece of electrical apparatus to the plater is a rheostat in series with each tank. It is well known that the character of deposit depends upon the current density at the cathode. We may suppose, for example, that the average pressure between the main conductors is about 3.5 volts. This might cause a sufficient current to flow through a cyanide copper solution to give a good deposit, while in the nickel solution it might cause the work to become "burned," to avoid which a rheostat in series with the nickel bath is necessary to reduce the current flowing to a value consistent with a good deposit. Again, a pressure of 3.5 volts might cause a good deposit when the tank is full of work, but if the amount of cathode surface is less, as when removing the plated articles, this same voltage may cause the formation of a dark deposit. This is due to the fact that the current does not vary as the area of cathode surface varies (assuming the anode surface to be kept the same), for the resistance of the electrolyte does not depend upon the cathode surface alone. This is contrary to information frequently given in instruction books for platers, in which statements are made that if the voltage is kept constantly at a fixed value there is no danger of irregularity of deposit. For this reason, also, a rheostat is desirable to regulate the current to suit the amount of work in the vat.

Two primitive methods are not infrequently in use to regulate the current. One is to hang anode plates on the cathode bar to protect neighboring work from burning. Another is to connect anode and cathode bars through a rheostat, shunting part of the current and producing a sufficient drop in the conductors leading from the dynamo to reduce the voltage at the tank terminals. The wastefulness of either of these methods is self-evident.

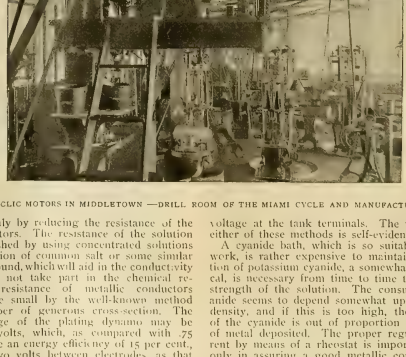


FIG. 2. MONOCYCLIC MOTORS IN MIDDLETOWN —DRILL ROOM OF THE MIAMI CYCLE AND MANUFACTURING COMPANY.

A cyanide bath, which is so suitable for general work, is rather expensive to maintain, as an addition of potassium cyanide, a somewhat costly chemical, is necessary from time to time to keep up the strength of the solution. The consumption of cyanide seems to depend somewhat upon the current density, and if this is too high, the consumption of the cyanide is out of proportion to the amount of metal deposited. The proper regulation of current by means of a rheostat is important, then, not only in assuring a good metallic coating, but also in preserving the solution.

A suitable rheostat requires considerable attention to its design and construction. One designed for use with a copper-sulphate solution may not be suitable for an equal amount of cyanide solution, and for this reason should be designed for the work in hand. It should be capable of carrying the total current of the vat without excessive heating, should be so subdivided as to allow close regulation and

constructed so that the contact points shall have plenty of bearing surface.

The most efficient working of a plating plant means a maximum output of plated work for a given equipment, and for this reason, as well as to get uniformity of work, it is desirable to always use as high a current density as is consistent with good work. Most expert practical platers regulate the current density by the appearance of the work, and such instruments as an amperemeter and voltmeter are regarded as a luxury instead of a necessity, but there is little question that a liberal and intelligent use of such instruments would do much to correct the mistakes which are so common, and that, used in connection with suitable current-regulating devices, it would result in actual saving by increasing the production, rendering the plating more uniform, and in the economy of solution and of power.

Some measurements recently made with an ammeter and voltmeter in a plating plant of the ordinary type are instructive. The tanks were four in number, three for nickel and one for copper, the capacities being 500 gallons, 200 gallons, 75 gallons and 150 gallons respectively. The dynamo was a well-built machine, shunt-wound, of 2,000 watts capacity (400 amperes at five volts), and the conductors to which the tanks were connected consisted of heavy copper wire, No. 0, B. & S. The rheostats were crude affairs of heavy iron-wire spirals, connections being made by the insertion of a copper wedge between adjacent rheostats. The results were as follows:

Speed of dynamo	910 r. p. m.
Average current delivered by dynamo	120 amperes
Average pressure at dynamo terminals	5.2 volts
Average pressure between anode and cathode	1.9 volts
Average drop in copper conductors	.1 volt
Average pressure electromotive force of polarization	.75 volt

This gives a consumption of power distributed as follows:

In overcoming counter-electromotive force	120 × .75 = 90 watts
Power actually consumed in tanks	120 × 1.9 = 228 watts
Power absorbed in rheostats	120 × 5.2 − 1.9 = 384 watts
Power absorbed in conductors	120 × .1 = 12 watts
Power delivered by dynamo	120 × 5.2 = 624 watts
Percentage of power consumed in tanks	36.5 %
Percentage of power consumed in rheostats	61.5 %
Percentage of power consumed in conductors	1.9 %

Assuming an efficiency of 75 per cent. for the dynamo, the consumption of power in the plating plant = 624 ÷ .75 = 832 watts = 1.1 horse power.

A number of measurements made by connecting the voltmeter terminals to the separate anode plates and the tank rods to which they were connected, or rather supposed to be connected, showed an appreciable electromotive force in a number of cases, indicating that the contact between plates and rods was no better than a number of the anode plates were not doing their full share in furnishing metal to the solution, which might be of sufficient amount to "strip" the solution of metal, and thus necessitate the continual addition of metal salts. A voltmeter is therefore a good instrument for the detection of poor contacts and defective connections, which might otherwise be difficult to locate.

A marked saving of power could be effected by reducing the voltage of the source of supply, thus reducing the amount of power which is otherwise necessarily absorbed by the rheostats, though, as previously mentioned, this might make the satisfactory working of the dynamo more difficult.

As less than two per cent. of the power is lost in conductors, there could be no further improvement here, and in fact there is more copper installed than could be profitably saved by the conductor-has to be absorbed by the rheostats. It may then be said that there is some justification for the quite extensive use in plating plants of brass tubing instead of solid copper, and that there is not so much need of applying the ordinary precautions for economy in electrical conductors that are used in electric-light and power-transmission lines. The requirements for conductors are that they shall carry the current without dangerous heating, and without a sufficient drop to reduce the voltage to a value lower than that needed by the tanks.

The above conclusions would apply only to electrodeposition plants where solutions of different character are used, and where the amount of work in the tank varies, and could not be followed in the case of deposition for refining of metals or in extensive electroplying plants.

Monocyclic Motors in Middletown.

During the last two years the number of central stations using that modification of the single-phase alternating system known as the monocyclic, by which current may be supplied to both lamps and motors at the same time from alternating-current generators, has greatly increased. With this system it was found that both arc and incandescent lamps, as well as induction motors, could be supplied from the same alternator, the first-named operating directly from the ordinary two-wire single-phase circuits, the motors merely requiring a third wire to give a displaced voltage.

An interesting example of the introduction of the monocyclic system into a direct-current station, allowing the area of its operation to take a wide extension, exists at Middletown, Ohio, where Mr. E. H. McKnight, the president and general manager of the Middletown Electric Light and Power company, has recently found it necessary to increase the monocyclic capacity of his plant to meet the increased call upon his station. In addition to the arc and incandescent lighting usual in towns of the size of Middletown, certain factories under progressive managers have adopted electrically transmitted power in place of steam, and the motor load on the station already far exceeds the lighting load.

The station fronts on the Miami and Erie Canal, having the tracks of the M. and C. railroad immediately behind it. It is 65 feet wide and 115 feet long. Steam is supplied from two Brownell & Co. Dayton boilers to one 450 horse power compound condensing Buckeye engine and one 300 horse power four-valve Russell condensing engine. The generating plant (Fig. 1) consists of two General Electric 12-pole, 150-kilowatt, 1,040-volt, 600-revolution monocyclic generators excited by two 1½-kilowatt exciters, three 50-light Thomson-Houston series arc dynamos and one General Electric 100 horse power 500-volt direct-current generator, all driven from countershafting furnished with the necessary friction clutches. The 500-volt machine is used exclusively to furnish direct current to several small motor

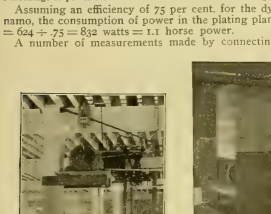


Fig. 3. Assembly Room Motor, Miami Cycle and Manufacturing Company.

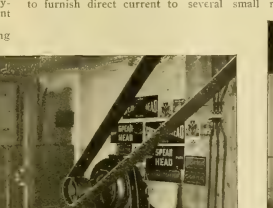


Fig. 1. Motor No. 1 in Factory of the P. J. Sorg Company.

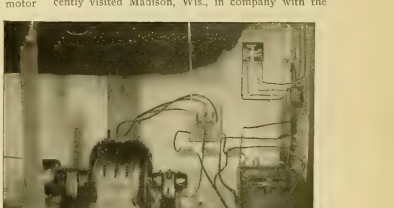


Fig. 5. Motor No. 2 in Factory of the P. J. Sorg Company.

MONOCYCLIC MOTORS IN MIDDLETOWN

plants throughout the city; the arc machines operate 112 city arc lamps.

The motor load on the monocyclic machines runs up to nearly the limit of their capacity. The factory of the Miami Cycle and Manufacturing company, a little over a mile away from the station, takes 200 horse power when its motors are running at their rated capacity, and considerably in excess of this under usual working conditions. The current is received in the factory in six 40 horse power, one 20 horse power and two 10 horse power transformers, reducing the pressure to 115 volts. The motor circuits run from the 40 horse power transformers, the lighting circuits from the three 10 smaller capacity, and all the current is measured in a recording wattmeter connected on the primary circuit. The motor equipment consists in all of 10 General Electric induction motors, three of 20 horse power in the machine shop driving 88 machines, one of 10 horse power in the drill and pattern room (Fig. 2) driving 20 machines, another of 10 horse power driving the machinery in the frame department, three of 30 horse power in the polishing room (two for the polishers and one for the 48-inch exhaust fan), one 40 horse power driving two plating dynamos in the plating room, and another of similar capacity operating a number of small machines in the assembling room (Fig. 3), as well as a three-phase 20 horse power induction motor in the factory number 750, of which during the rush season almost all are lighted.

In addition to the cycle factory Mr. McKnight furnishes power to the tobacco factory of the P. J. Sorg company, for which two departments are already equipped, each with a General Electric 30 horse power induction motor. The first (Fig. 4) is the smoking-tobacco department, on the first floor, and is belted to shafting operating on the three floors above, three Caldwell pickers, one cutter, two granulators and two dust machines. The second motor is on the sixth floor (Fig. 5), and is shown with the transformer and the motor to which the primaries from the station are connected. From this point secondaries are carried to motor No. 1 in the smoking-tobacco department, distant about 500 feet, and the lights in the different departments being tapped off before the motor is reached. Motor No. 2 drives two 7½-inch Sturtevant fans used to dry all the tobacco. It also operates a five-ton elevator. The capacity of the drying department is 100,000 pounds of tobacco daily.

The benefits of electric drive by induction motors are, perhaps, nowhere more forcibly demonstrated than in these two installations. In the cycle factory the constant speed of the machinery, the absence of vibration and the power of the motors to respond to calls reaching as high as 50 per cent. over their rated capacity, have enabled the manufacturers to give to every part of their wheels a perfect finish, as well as to greatly increase the output. In the tobacco factory, the steady rate at which the tobacco passes through the dryers gives it a uniform cure. Previously, the speed being variable, the tobacco would dry in spots only, and a second handling was almost always necessary. According to the foreman, the motor "saves him lots of time."

The incandescent lights in the town already wired number 3,800. Of these 750 are in the cycle factory, 100 are in the tobacco factory, 650 are in the opera house and 2,300 in other parts of the town. These lamps burn with no interference from change in the motor load; in fact, the entire motor load may be thrown on or off without in the least affecting the burning of the lamps, the presence of the motor load being usually only determined by reference to the ammeter. The monocyclic machines operate with almost perfect regulation, requiring little or no attention to maintain the constant potential at all times.

Reorganization of the Madison Electric Railway.

S. M. Hamill of the Brush Electric company recently visited Madison, Wis., in company with the committee of bondholders of the electric railway of that city to arrange for the reorganization of the property. The committee purchased the property from the receiver and reorganized it under the name of the Madison Electric Railway company, and elected Major F. W. Oakley, who is clerk of the United States District Court of Madison, president, George W. Russell of Cleveland, Ohio, vice president, H. R. Newcomb of Cleveland, treasurer, and George Shaw of Madison, manager. The executive committee of the board of directors consists of Messrs. Newcomb, Russell and Hamill. Since the bondholders' committee has been giving attention to the property the whole system has been reorganized and newly equipped with a complete summer equipment of open cars and "G E 800" motors. A new five-years' contract was entered into with the local electric-light company for current and about $7,000 set aside for additional improvements, in addition to a new brick car-barn, which will be built some time this year. Madison is considered by many the best street railway town of its size in the country. This is partially due to the fact that it lies between two lakes and is long and narrow. The citizens of the town built an extension costing about $12,000 and presented it to the road under an agreement that the company was to operate it.

The present owners of the road contemplate many changes that will assure first-class service, and the people of Madison are well pleased with the arrangement.

Joseph P. Smith, Bertram S. Morrill, John W. Kaiser, Bernard T. Warthen and Theodore E. Dollard have incorporated the Heat, Light and Power company of Baltimore, with a capital stock of $10,000. The company is authorized to conduct and operate overhead wires for illuminating purposes and to furnish motive power for machinery and such other purposes as electricity may be used. It may also lay underground pipes or conduits to contain wires.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, news, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Frank Forster Kenworthy being duly sworn deposes and says that he is a resident of the city of Chicago, in the county of Cook and state of Illinois, and that he is the superintendent of the Binding department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the binding of No. 24 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were sent out by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified.

And further this affiant sayeth not.

FRANK FOSTER KENWORTHY.

Subscribed and sworn to before me this 27th day of July, 1897. Chicago, July 27, 1897. IRA B. JONES, Notary Public.

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Time is money in the Yukon Valley, and in Dawson City the gold seekers are bound to make the most of every minute. At least they are not going to waste any more time in conveying messages from one point to another. A telephone-exchange equipment is now on the road to that point and will soon be in operation. A 100-number switchboard and 100 instruments comprised the first installment.

An interesting incident in the Cuban complication was the announcement of the sale of the street railways last week. A dispatch from Havana on March 25th said: "The control of all street-railway lines has been transferred to an English syndicate. The Spanish owners apprehend confiscation by Americans or insurgents." Another explanation is that the fear of forced loans had something to do with it, as Sagasta notified the autonomistic government that after May Cuba would be expected to raise money for its own maintenance. At any rate the newspapers have modified their abuse of Americans temporarily and are now reproaching the Spanish who have parted with their railway securities. They interpret this action as a reflection on the power of the Spanish government, claiming that the sales indicate that while the foreigners have confidence in the future of the island the Spanish have no belief in the permanency of their control over it.

Along with the other preparations that the government is making to meet the crisis now pending in the Cuban controversy, is the completion of a system of telephonic and telegraphic communication between the several coast defenses and Washington. Telephone equipments have been ordered for several points along the seacoast, and special telegraph lines are being strung between important points to insure communication. From Washington comes the news that among the emergency preparations that have been made is a large increase in the telegraphic facilities of the white-house and the Navy and War departments.

Long-distance telephones have been supplied and the telegraph companies have strung seven additional wires to the War and Navy departments, and several additional connections have been made with the executive mansion. Cable communication with Cuba is being watched closely at this time and unusual precautions have been taken to ensure the satisfactory working of the line.

Col. Frank, commandant at Fort Henry, has made a remarkable statement concerning the condition of that point. Wires have been laid from Capes Charles and Henry across the channel leading into Chesapeake Bay and Hampton Roads, and submarine mines or torpedoes could be attached to them with very little trouble or delay. This work will no doubt be carried to completion as quickly as possible, because Fort Monroe would be utterly ineffective against the Spanish torpedo flotilla should it make an effort to pass that fortification, according to the commandant.

Conflicting statements concerning the policy of the city administration toward the Chicago street-railway corporations upon the subject of fenders have been issued by the law department and commissioner of public works. The street-railway corporations have contended that the ordinance under which Mayor Harrison proposed to act was invalid and they have acted accordingly. Now Corporation Counsel Thornton takes the same position. When the subject was brought to his consideration on Monday last he held that the fender ordinance was invalid, and, on the request of the mayor, drew up a new ordinance, which is exactly the same as the first one, except that it provides for basket fenders instead of any type that may be approved by the mayor and the commissioner of public works.

Another announcement was made on Wednesday, when it was said that Mayor Harrison had determined to make an attempt to enforce the present fender ordinance in spite of the fact that Corporation Counsel Thornton had decided that it was faulty in form. The mayor and Commissioner McGann had a long conference over the matter on Tuesday. They concluded that it would be difficult to get the council to pass another ordinance, as the street-railway companies would be sure to fight it. The present measure was introduced at a time the companies were not looking for it, and went through before opposition could be organized. The mayor has, therefore, determined to make a test of the present ordinance before abandoning it entirely.

The commissioner of public works is reported as expressing the opinion that "there is something more than the fender ordinance at stake in this matter. The principle of how far I can superintend the construction of work done under city ordinances is to be determined. If I can say what kind of fenders are suitable, then the Nelson ordinance is a good one, and that is the point we have got to have passed upon. I shall have prosecutions against the companies begun at once."

It may be mentioned that the street-railway companies have welcomed the issue, as they are anxious to have their position determined by the courts. The legal departments of all the street-railway companies of Chicago are unanimous in pronouncing Mr. Thornton's position correct in this matter. The outcome of the controversy will be watched with interest by street-railway companies throughout the country.

Marine testing tanks are now generally employed for the determination of many important facts bearing upon the design and construction of naval vessels, and invaluable data have been obtained by this means, but this information is in the possession of the governments that have discovered it, and it is zealously guarded in their naval archives. Marine engineers find it difficult and sometimes impossible to secure statistics of great value, because of the lack of facilities for individual research and experiment. For this reason the announcement that a marine testing tank for models is being built at Cornell University is commanding attention in engineering circles. It is the desire of Cornell to make experiments which will be in the line of pure science. The idea is to establish a set of general rules or laws which can be used by constructors, to point out exactly what every kind of propeller will do, what every shape of boat will do under varying conditions, how much power would be needed to propel certain boats at certain speeds, and the limitations which would govern these performances. Marine engineering should have a scientific basis, and very little work has been done in this line outside of governmental circles, at least in this country. Government tanks and nearly all private tanks are for the most part occupied with commercial problems, having something to do with a particular ship or a particular propeller, for example, but the information thus gained is locked up. It is for the benefit of government design, and not for the advancement of general engineering science. The Cornell tank will be somewhat similar to that now being built for the government, which has already been described in this journal. The tank in Ithaca has a trolley-car structure extending across it which is capable of being propelled electrically from one end of the tank to the other at any speed. This is for the purpose of testing the speed, thrust and area of propellers. It is also used in connection with the determination of the shape of vessels' hulls. It is supplied with delicate testing instruments. The operator rides upon it as it moves along the tank, dragging after it the model of a man-of-war in the water, or a special apparatus carrying small propellers. The operator can work the structure by means of switches in circuit with the electric motors. If the model of a boat is being tested it is placed in the water under the trolley structure and drawn forward by a vertical metal rod, which extends up through the structure and impinges upon a recording mechanism. The completion of this tank will give this country two valuable equipments, the most perfect in the world, as the government tank now being built is fully equipped with the latest instruments, and is said to be the largest in the world. Great Britain has two marine testing tanks, one at Portsmouth, which is owned by the government, and another in Scotland, which is not public property. Italy and Russia have each one tank. None of the other great powers have modern testing equipments of this kind.

Death of Nelson W. Perry.

(Special dispatch to the Western Electrician.)

New York, March 29.—Nelson W. Perry, the well-known electrical journalist, author and engineer, died at his residence, 18 Sidney place, Brooklyn, at seven o'clock on Sunday evening. Mr. Perry's death was due to his ardor in pursuing a scientific experiment at his home on Saturday evening. He was at work on an incandescent gas-burner which he had invented, and to observe the success of his efforts it was necessary at times that the room should be darkened. At such a period of darkness Mr. Perry reached for a glass of water and by mistake took a glass containing bichromate of potassium, drinking its contents. The fatal error was immediately discovered, and two physicians were summoned. Emetics were administered, and it was thought that Mr. Perry's life would be saved, as he seemed to rally from the effects of the poisonous draught and to improve during the night. His condition on Sunday morning was much worse, but he gradually rallied and at noon was thought to be out of danger. In the meantime, Mrs. Perry was summoned from Baltimore, where she had been taking medical treatment. She arrived at her husband's bedside at one o'clock. The meeting was an affectionate one and seemed to greatly excite Mr. Perry in his weakened state. He experienced a relapse from which he never recovered, gradually sinking until his death at 7 p. m. W. F. O.

Mr. Perry possessed a rare combination of talents. He had real engineering ability, grace and felicity as a writer and an engaging personality. He was firm, even aggressive, in advancing his own views on engineering and other topics, but he was always courteous, and although widely known, he had few if any enemies. He was well educated and had supplemented his early training by acute observation, original research and wide reading. Yet he was in no way pretentious; he had an inquiring mind and delighted to inform himself on all subjects. He was quick-witted and could be a delightful companion. Not a perfect man by any means, Nelson Perry was nevertheless a very likable one, and his death has brought a pang of genuine sorrow to many hearts.

Mr. Perry's career was a varied one. It shows the versatility of the man. Nelson W. Perry was born in Columbus, O., May 22, 1853. He came of good family. His ancestors were of Puritan stock and his father was an honored judge and a member of Congress. He was educated in the public schools of Cincinnati, and later at Phillips Exeter Academy, Harvard University and the School of Mines of Columbia University. He graduated from the last-named institution with the degree of E. M. at college Mr. Perry was prominent in athletics as well as in his studies. Immediately after graduation he was appointed economic geologist and mineralogist on the United States Geological and Geographical Survey of the Territories. In 1880 he was appointed to the chair of metallurgy at the University of Colorado, and for a number of years thereafter he practiced his profession of mining engineering, both in the Rocky Mountain region and in the republic of Mexico. During this period he did valuable research work in chemistry, evolved a new method for making platinum assays, discovered, analyzed and described two new minerals, which he named gunnisonite and ramasite, from the localities, Gunnison County, Colorado, and Ramos, state of San Luis Potosi, Mexico, near which they were discovered, and contributed several important papers to various scientific societies. At this time he was elected corresponding secretary of the American Institute of Science and Arts, Mechanics' Institute, member of the American Institute of Mining Engineers, foreign member of the Deutsche Gesellschaft fuer Chemie of Berlin and of the Societié Chemique of Paris.

Mr. Perry took up electricity in 1887, and in the following year he gave up mining engineering to go into electrical engineering. For several years thereafter he was connected with a number of the great companies engaged in the Edison-Houston, Brush, Short and Edison General Electric companies. In 1891 he came to Chicago as one of the editors of Electricity, then newly established in this city, succeeding a few months later to the position of managing editor. Not long after that he resigned from the paper and practiced his engineering profession independently, but in a short time he was offered the position of associate editor of Electrical World, in New York, which he accepted. Mr. Perry remained with the Electrical World but a short time, but during the period he contributed a fine series of articles from the World's Fair in Chicago. Afterward he returned, as editor, to Electricity, then, as now, published in New York. At one time Mr. Perry was the associate editor of the Engineering Magazine, and he has written much for the electrical and engineering journals of this country and Atlantic, including the Western Electrician. He was awarded the John Scott Legacy Premium and Medal in 1884 by the Franklin Institute of Philadelphia for his series method of electric traction. He was vice-president of the New York Electrical Society in 1897, and was also a member of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Mr. Perry was the author of "Electric Railway Motors: Their Construction, Operation and Maintenance," a useful book for motormen, written in 1894; and his papers on scientific and technical subjects would fill several volumes. Mr. Perry resigned from Electricity a few months ago to accept a position with the New York engineering staff of Westinghouse, Church, Kerr & Co., but this place he had also relinquished a short time before his death.

American Institute of Electrical Engineers.

At the meeting of the Institute in New York on March 23d, a paper by Prof. R. A. Fessenden on "Insulation and Conduction" was presented by R. W. Ryan, in the absence of the author, and discussed by Prof. Frank Iin and Dr. Pupin. About 75 members and guests were present.

The secretary announced that at the meeting of council in the afternoon the following nominees had been selected from the proposals submitted by members:

For president, Arthur E. Kennelly.

For vice-presidents, Robert B. Owens, William Stanley, Cary T. Hutchinson.

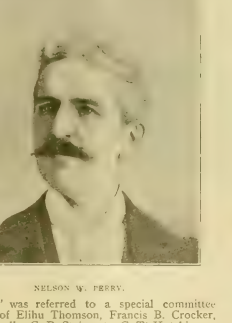
For managers, Herbert Lloyd, Samuel Sheldon, George F. Sever, Charles P. Steinmetz.

For treasurer, George A. Hamilton.

For secretary, Ralph W. Pope.

The following-named officers continue their terms as provided in the constitution: Vice-presidents, A. E. Kennelly, Charles S. Bradley, D. C. Jackson; managers, J. W. Lieb, Jr., F. A. Pickernell, W. L. Puffer, L. B. Stillwell, Alexander Macfarlane, W. F. C. Hasson, Gano S. Dunn, Herbert Laws Webb.

The question of "Standardization of Electrical



NELSON W. PERRY.

Machinery" was referred to a special committee composed of Elihu Thomson, Francis B. Crocker, A. E. Kennelly, C. P. Steinmetz, C. T. Hutchinson, J. W. Lieb, Jr., L. B. Stillwell.

The following-named associate members were elected: Albert G. Davis, Schenectady, N. Y.; Albert R. Gallatin, New York; Herbert Gaytes, Oakland, Cal.; Russell Agnew Griffin, New York; Francis Valentine T. Lee, San Francisco, Cal.; Max Loewenthal, New York; Henry W. Pope, New York; Fritz Reichmann, Austin, Texas; Theodore E. Theberath, San Francisco, Cal.; Robert Anton Fliess, New York.

The opening date of the general meeting at Omaha was fixed for June 27th, and its continuation for either three or four days has been left with the committee on papers and meetings for decision.

Death from Electrical Shock at Low Potentials.

In Germany there has been much discussion of the alleged fact that persons coming with fatal pressure did not exceed 115 volts in any of these cases, but in doing so it did not publish the name of the factory or the precise nature of the processes carried on there. The German dailies appear to have made much out of this article, not omitting to point to the fact that in the majority of installations a pressure of 115 volts is used. The Hanover Union social society at a recent meeting, discussed the harm such articles would do to the electrical industry, and resolved to protest to the Verband Deutscher Elektrotechniker that its organ the Elektrotechnische Zeitschrift should have published the article referred to, and called on it to take steps to obliterate the harmful effect caused by its publication. At the same time the Hanover society has addressed other electrical societies in order to obtain their opinions on the matter.

The Frankfort Electrical society, in considering the circular of their friends in Hanover, has agreed to differ from them entirely, holding that the Zeitschrift is to be commended for calling attention to a hitherto-neglected source of danger. On this state of affairs the London Electrician makes these sensible observations: "While agreeing with the Frankforters that accounts of such accidents should always be published in the technical press, even if only as a warning, we think that too much care cannot be bestowed on the manner in which they are worded. We call to mind several cases nearer home where technical journals have published misleading particulars of this character, which inquiry would promptly have modified. Instead of withholding the name of the works at which the accident occurred, full particulars of all the facts and conditions which could in any way help to elucidate its cause should have been given, and more emphasis should have been put on the fact that this was essentially a 'particular case' from which no general conclusion as to the danger from low-pressure shocks could be drawn. The tendency of the lay press of all countries to make a sensation of any news item that partakes of the mysterious is well known and should be reckoned with in such cases."

Sussman Mining Lamp.

In a paper read before the alumni of the Mining School at Liege, Belgium, G. Nicolas gives an interesting description of the Sussman electric lamp for miners. This lamp is based on the use of a dry accumulator which was adopted in order to meet the objections raised against batteries with liquid electrolyte. The Sussman accumulator uses a paste of paper or cellulose formed into a plastic mass, which gives, it is said, but little more resistance than a liquid electrolyte. Its adhesive quality also serves to protect the electrodes and hold them in place, preventing them from slipping and causing short-circuits. The material used is filter paper reduced to a dry powder. This is moistened with sulphuric acid, but the quantity of acid used is so small that it does not interfere with the portability of the lamp, which can be carried in any position or turned upside down without injury. The active matter used in making the plates is lead oxide in fine powder formed into a paste with a weak solution of indiarubber and sulphate of ammonia.

The lamp is of the usual form in miners' lamps and consists of the case carrying the battery and of an incandescent electric lamp, suitably protected. The battery is composed of lead plates pierced with holes and covered with a paste of lead oxide prepared as described above. The approximate dimensions of the plates are 100 by 56 millimeters and five thick (3.94 by 2.20 inches and 0.20 inch thick); their weight is 230 grammes (0.51 pound) for the positive and 175 grammes (0.38 pound) for the negative.

The ebonite case in which the accumulators are placed is divided into two compartments, inclosing the two elements. It is 125 by 65 by 65 millimeters (4.93 by 2.56 by 2.56 inches) and is placed inside a sheet-iron casing, the outside dimensions of which are 145 by 70 by 70 millimeters (5.71 by 2.76 by 2.76 inches). Each compartment of the ebonite case contains a positive plate and two negative plates separated by two liners of rubber. The whole is covered with a layer of insulating matter, and is provided with a small tube which serves to permit the gases generated to escape, and also to permit the introduction of the acid needed to moisten the electrolyte.

The light is protected by a thick glass cylinder, which is placed above the sheet-iron case, and which has a sheet-iron cap resting on the top of the lamp. The accumulator case and the cap are held together by four small bolts. The joints between the glass and the metal are made tight by rubber rings, which also serve to take up shocks. The cap is provided with a hook for suspending the lamp, and reflector can be placed behind the light. The top is about 70 millimeters (2.76 inches) high, making the lamp in all 215 millimeters (8.47 inches) in height. Its total weight, ready for use, is 1.98 kilogrammes (4.37 pounds). The lighting power is about five times greater than that of the ordinary miner's lamp. The expense of recharging the lamp is not heavy. The power required to charge 1,000 lamps at a time is 3.7 horse power.

A lamp will burn without any attention from 12 to 16 hours. At the Strepy-Bracquegnies colliery in Belgium the cost of the lamp, including all repairs and the renewals of the incandescent film, was found to be 35 centimes (7 cents) per day of 12 hours. The miners preferred the Sussman lamp because it gave a much greater light and it was not necessary to have it so close to the work, nor to change its position often because it was reliable, and because it would give light equally well in any position. At this colliery a lamp was given to each foreman, to each road-cutter and to each group of six coal cutters.

The chief objection which has been raised to it is that it will not serve as a detector of the presence of fire damp, as the ordinary miner's lamp does. It is probably that where this lamp is used some kind of fire damp indicator would have to be provided.

The city of Hagerstown, Md., contemplates the issuance of $60,000 in bonds for the erection of an electric plant to supply light, heat and power.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Telephone Movement.

[From the London Electrician.]

To all interested in telephony, but especially such as are interested in the independent telephone movement in the United States—a movement which has been growing since the field has been opened by the expiration of the fundamental Bell patent—the issue of the Western Electrician of Chicago for February 26th may be commended for notice. This number is almost entirely devoted to a discussion and descriptions of the various independent telephone concerns as opposed to the Bell company. It is stated that there are, in round numbers, about 2,500 independent exchanges in operation in the United States to-day.

[From the London Electrical Engineer.]

The great demand now growing in this country for cheaper rates for telephones, and for exchanges to be established on the co-operative principle, gives interest to the speculation as to whether the competition so obtained will be an ultimate boon. With more subscribers, due to cheaper rates and equal trunk-wire facilities, it would appear that much good would result, but it is hardly likely that the National Telephone company would allow their lines to be used for distributing trunk messages. In that case mutual co-operation between the independent exchanges would be necessary to make this opposition at all powerful. It is interesting in this respect to see what has been done in the States. From the technical press it is difficult to gauge the true state of affairs. Certain journals, starting as advocates of the independent exchanges, have veered round, and now damn them as being merely company-promoting schemes. Still, the Bell company is rich, and may have called the tune in these instances. At any rate, we are glad to see the Western Electrician take up the independent exchanges. In the leader of the current number the editor states that * * * [Editorial reproduced from issue of Februray 26th.] We only trust that the opposition movement will not degenerate into an amalgamation in favor of the shareholders, as has been the case in cable work.

Telephones for Coast Defenses.

Both the War and Navy departments have recently placed rush orders for telephone equipments with the American Electric Telephone company of Chicago for the coast-defense forts and for the navy yards. All orders have been marked "emergency purchases" in red ink, indicating that they were to be paid for out of the fund placed at the disposal of President McKinley by Congress. The company shipped on March 28th a full equipment for Pensacola, Fla., and under telegraphic orders is pushing work on other orders for the government as fast possible. The points for which the telephone equipments are destined embrace all coast-defense forts.

P. C. Burns, the president of the American Electric Telephone company, said that the tenor of the orders and the urgency of the telegrams asking for as immediate shipment of the orders as possible were an indication of much more than ordinary need for quick work in the installation of the telephones. The system which the government has chosen for this work is especially adapted for long-distance telephoning. The orders so far are confined to the coast defense forts of the East and South. From both the War and Navy departments, it is said, come many messages asking quick work in preparing and shipping these supplies, and each day for the last two weeks has brought new orders for additional equipments.

A Bell Investment.

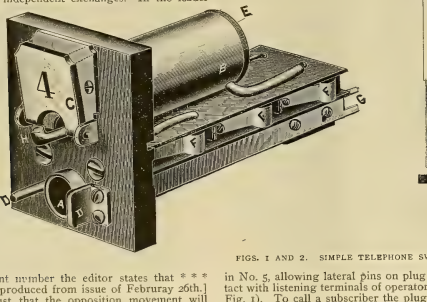
The Electric City Telephone company of Great Falls, Mont., an independent company, has sold its exchange to the Rocky Mountain Bell Telephone company, and the announcement was made by Manager Wade that the service would cease March 31st. A circular has been sent out explaining that it proved more expensive to conduct the exchange than had been anticipated. One of the stockholders has secured a temporary injunction to stop the sale, and he claims it is the result of a conspiracy.

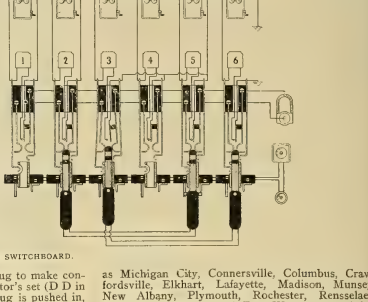
Simple Telephone Switchboard.

After several months of experimental work the Graham Electric company, Rialto building, Chicago, has perfected and put on the market a new telephone switchboard for metallic circuits. This board contains several novel features, all tending to simplify it and reduce the number of parts to a minimum. It does away entirely with all ringing and listening switches, levers, cams, push-buttons and clearing-out drops. The jacks and drops are mounted together, as shown in Fig. 1, and, as no clearing-out drops are required, the switchboard is compact and takes up little space.

Each drop and jack is independent of the others, allowing any one to be removed without disturbing the rest of the switchboard, or disconnecting any line wires, as these are soldered to brackets from which the jacks are readily detachable. The board is claimed to be remarkably fast in operation and free from cross-talk and internal dissensions. The switchboards are all wired for metallic circuits, but can be used for either common return or ground circuits, any one or all on the same board. The construction of the plug makes all ringing and listening connections and clearing-out, without switches, levers and push-buttons.

Fig. 2 shows a diagram of the circuits in ringing, listening and talking positions. No. 1 and No. 2 are full metallic circuits; Nos. 3, 4 and 5 are common return, and No. 6 shows a ground circuit. When the drop falls the operator plugs in as shown in No. 5, allowing lateral pins on plug to make contact with listening terminals of operator's set (D D in Fig. 1). To call a subscriber the plug is pushed in, as shown at No. 3. This pushes the ringing terminals against the line. On removing the hand the plug is pushed out, restoring the through connection, as shown at No 2 and No. 5.





FIGS. 1 AND 2. SIMPLE TELEPHONE SWITCHBOARD.

These switchboards can be built with a cabinet capacity in excess of the number of drops and jacks required, thus providing for future demands from increased business.

Spring Moving and Telephone Service.

The numerous changes in places of business and residence that are made or contemplated at this season of the year in all large towns involve considerable trouble on the part of telephone-exchange managers, who must be prepared for the rush of orders for new service and removal of instruments from abandoned offices. In the principal cities of the country and in many of the smaller places where the use of the telephone is quite general, it is customary for the local company to canvass its subscribers and in advance as possible the number of removals that are likely to take place and the new location of the subscribers. In Chicago, for instance, the following notice was sent to all subscribers of the Chicago Telephone company:

As the majority of the lines of the Chicago telephone exchange system are now connected in underground cables, and the complications in making connections are numerous, also, as there will be a large number of telephones to be moved about May 1st, it is necessary that we have at least 30 days' notice where subscribers desire to have their telephones moved from one office to another.

It will, therefore, vary much expedite this work and avoid interruptions and delays if subscribers will fill out the enclosed blank and return it to us not later than March 25th, that we may execute their orders promptly and with as little interruption to the service as possible.

The order form adopted by the company contains the following provision:

It is agreed that the removal of the telephone, in accordance with this order, shall constitute an express extension of the existing contract between the parties for a period of one year from the date of completion of such removal, and that I am to pay the actual cost of making such removal and connecting up the telephone in the new location.

The Telephone Situation.

By J. J. Nate.

Part IV.

Competition

This element in the work of independent organizations presents a most difficult problem to the promoter. Perhaps this would not be true if the opposition could be dealt with in fair and square competition. Whether it be the policy of the Bell company or not to frighten by misrepresentation and intimidation, those who have experienced the result of competition of whatever character are best prepared to say. I believe, however, from information at hand, that many of the agents and representatives of that corporation are far from honest in their methods of combatting the independent movement; with what degree of success is not so much a question of doubt to-day as it was two years ago. In verification thereof, let us look over the field briefly and ascertain what has been accomplished by the independent telephone companies in three years. In Ohio, Indiana and Illinois the Central Union (Bell) company has practically lost the business of many prominent exchanges. True, in some cities and towns its instruments are still left on the premises of the subscriber, but, as a rule, they are not paid for, or, if paid for, at a rate much below an earning revenue. A movement now on foot for the establishment of an exchange in the city of Indianapolis, if successful, will take from the Central Union Telephone company its most prominent exchange. Victory at Indianapolis implies success at Columbus, Toledo, Cleveland and other large cities within its territory. As the matter stands to-day the company has lost such exchanges as Michigan City, Connersville, Columbus, Crawfordsville, Elkhart, Lafayette, Madison, Munsey, New Albany, Plymouth, Rochester, Rensselaer, Shelbyville, Wabash and Fort Wayne, in addition to the establishment of probably 100 additional exchanges, ranging from 50 to 150 subscribers, many of which were installed and have retained their prestige in opposition to the Bell company from the first.

The Michigan Bell Telephone company has lost such exchanges as Benton Harbor, St. Joseph, Alpena, Grand Rapids, Muskegon, Kalamazoo, Ishpeming, Marquette, Iron Mountain, Escanaba and Detroit, in addition to which are a hundred or more independent exchanges, ranging from 50 to 150 subscribers each, and the coming season will see the installation of independent exchanges at Bay City, Saginaw, Flint, Battle Creek, Jackson and other prominent points.

In the state of Illinois there are over 100 exchanges in satisfactory operation, and all members of the state association. Included in the list are to be found some of the best towns in the state, such, for instance, as Bloomington, Danville, Decatur, Paxton, Watseka, Kankakee, Woodstock, Carthage, Augusta and Cairo.

In Iowa the Bell company has practically lost the business of the most important towns, among which may be mentioned Des Moines, Cedar Rapids,, Decorah, Dubuque, Keokuk, Marshalltown, Oskaloosa, Sioux City, Waverly, Waterloo and Cedar Falls, to say nothing of the loss in toll-line receipts from this and other states.

Wisconsin and Minnesota have also done good work with independent exchanges and immense toll-line mileage. The list includes such points as La Crosse, Prairie du Chien, Winona, Deadwood, Rochester, Owatonna, Wausau, Merrill, Baraboo, Oshkosh, Sheboygan, Grand Rapids, Menomonie, Sparta, Eau Claire and Madison.

These are only a few cities and towns selected from a list of exchanges numbering in total over 1,600 independent exchange companies now in operation. It has been represented that there are over 2,400 independent exchanges now in operation in

this country. It makes little difference, however, as the work accomplished thus far is something truly marvelous, and in a little over three years over 1,600 independent telephone exchanges have been installed in this country, many of which are in successful operation at some of the best points heretofore controlled by the Bell company's exchanges. With few exceptions the independent exchanges are prospering and making money, with a total list of connections numbering at least 250,000 telephones. When we stop to consider that it was several years before the Bell company reached this number in total output, it is really remarkable.

A popular method employed by the Bell company as a means of discouraging prospective investors and subscribers to an exchange system is the reprint of letters received from people who object to two telephone exchanges operating in the same place. I have before me a little pamphlet filled with such letters, issued by the Central Union Telephone company, which I am told is at the present time being largely circulated throughout its territory. I fail utterly to see the advantage gained by this move. No one conversant with the business, not even the opposition, has ever claimed that two exchanges are desirable, and all will admit that one is sufficient, but this admission does not carry with it a statement to the effect that the home exchange should be controlled by the Bell company or its licensees. The pamphlet referred to herein is entitled "A Business Question, Some Facts." This is practically the title appearing on a similar pamphlet issued by the Home Telephone company of Sioux City last June, as an answer to letters written on the subject by citizens of that city, and as it very thoroughly illustrates the situation, I very carefully summed up the result and found that this company had issued a little book which simply gives a list of subscribers after eliminating all names of those subscribers who have in their business places both telephones. The list then follows in the "deadly parallel," and shows that the Bell company had at that time a total of 89 telephones in service in business offices where the Home company's instruments were not in use. The Home company's list under similar conditions shows a total of 340. Why should 340 citizens and interested business men of a community surrender to the wishes of 89 whose interests would seem to lie with the Bell monopoly? How much easier for the 89 to come into the fold, thus making it possible for those who are retaining both 'phones to throw out the Bell instrument and devote their money to the building up of local enterprise!

This matter has become of such serious import that such corporations as the American and United States Express companies have found it desirable to issue instructions to their agents to the effect that it would be well to discontinue the service of one telephone, using their judgment in the matter of selection, preferring the telephone which means the most business. So far as I am able to ascertain, at all points where the home company has the strongest list of subscribers, these agents are retaining the independent company's apparatus. At Jacksonville, Fla., recently a meeting of business men was called for the purpose of "putting a stop to the two-telephone nuisance," and the verdict of that gathering was in substance the abandonment of the Bell instruments in that community altogether, it having been ascertained from two years of actual service that the home company was giving better and more satisfactory service than the Bell in all its 17 years had ever supplied.

I desire to say before concluding this paper that I am not conversant enough with independent telephone exchange work in the extreme eastern and western states to warrant much more in an explanatory way than is very generally known. The following list of cities, taken at random, shows what headway the opposition is making:

Charleston, S. C.	Johnston, Pa.
Richmond, Va	Santa Fe, N. M.
Jacksonville, Fla.	Sacramento, Cal.
Vicksburg, Miss.	York, Pa.
Mobile, Ala.	Fort Wayne, Ind.
San Jose, Cal.	Detroit, Mich.
Portland, Ore.	Grand Rapids, Mich.
Newark, N. J.	St. Louis, Mo.

Nearly all of these exchanges have been in operation for two years, some over three years, and I believe inquiry will show that in every city named the home company has the largest list of paying subscribers.

With such results before us, after three years of remarkable success, I predict that the independent telephone companies of this country are permanently established and will continue to multply and prosper

The Telephone in Dawson City.

Dawson City does not possess all the advantages of metropolitan life, but it proposes to have every facility for quickly transacting business. Consequently a telephone exchange was demanded. An order was placed with the American Electric Telephone company of Chicago for a 100 number board and 100 telephones. The equipment was sent by express to Seattle. The apparatus was packed in long, narrow boxes, two telephones in each package. The switchboard was also built in a long, narrow frame, especially adapted for shipment to the Yukon. The Central Electric company of Chicago furnished supplies for the same order.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Mayor Doran of St. Paul has signed the franchises granted to the Mississippi Valley Telephone company for a local exchange, the Minnesota Central Telephone company for long-distance service, thus terminating the great fight in St. Paul over telephone competition. The representatives of the Northwestern Telephone Exchange company have been active in opposing the franchises and the new company's friends have also been active. The new companies now have franchises in both Minneapolis and St. Paul, and expect to have exchanges in operation in six months. They claim to have 2,300 subscribers in Minneapolis, against 2,100 now served by the Northwestern, and they will begin work as soon as the frost is out of the ground.

The independent telephone companies will begin work on toll lines from Marshalltown, Ia., to Des Moines, Webster City, Fort Dodge, Story City, Ames and Nevada, Ia., in the early spring.

A telephone exchange will be established in Dunlap, Ia.

The directors of the Iowa Telephone company have decided not to remove their headquarters from Davenport to Des Moines.

A telephone exchange will be installed at Wanamaker, Ia., the Wanamaker and Kellerton Telephone company being formed for that purpose. A toll line will connect with Kellerton also.

Dr. J. C. Hennison has a private telephone system at Bellevue, Ia., to which he will make extensions in the spring.

A telephone system is proposed in Scott County, Minn., to connect a number of the smaller towns with Shakopee, the county seat.

There is talk of a telephone exchange for Luverne, Minn.

The Marshalltown and Boone Telephone company has been incorporated to build a toll line between Marshalltown and Boone, Ia., to connect the independent telephone exchanges in those towns.

P. J. Raarup has completed the toll line of the Wisconsin Valley Telephone company to Bayfield, Wis. The company proposes to put in metallic circuit as rapidly as possible.

The Northwestern Telephone Exchange company is changing over Minneapolis to a metallic system, and is equipping its instruments for the new switchboard which is to be put in this spring. While this change was projected some time ago, it is noticed that work has been much more energetically pushed since a competing company has been admitted to the field.

The Rocky Mountain Bell Telephone company has let contracts for 4,000 poles, to be used in the line to be built between Mullan, Idaho, and Missoula, Mont. The new line is to be completed by July 1st.

The Cumberland Telephone company of Cumberland, Wis., contemplates extending a toll line to Camp Dixon, Timberland and other points.

Arrangements have about been concluded by the Mutual Telephone company of Des Moines, Ia., to install a 200-drop system in Atlantic, Ia.

The Iowa State Senate has passed a bill permitting cities to own and operate telephone systems. It is understood that it was passed to permit the city of Des Moines to purchase the system of the Mutual Telephone company of that city.

C. J. Smallwood is completing arrangements to put in a local telephone system at Worthington, Minn.

The Winona Telephone company of Winona, Minn., has arranged to connect at Witoka, Minn., with the Rushford, Minn., telephone system, and through that city with Decorah, Ia.

Work has been begun on the Union Telephone company's line to connect Wautoma, Wis., with Hancock and other points.

Citizens of La Moure, N. D., rejected the offer of the Midland Telephone company to connect their city with Edgeley, N. D., and towns to the west for a bonus. Instead they will appeal to the Northwestern Telephone Exchange company to give them connection with cities east to the Twin Cities.

The Western Electric Telephone company is working on a toll-line connection through Marshall, Minn.

The Dakota Central Telephone company of Aberdeen, S. D., has been granted toll line connection privileges at Watertown, S. D., and proposes to connect through Watertown with the Minnesota Central Telephone company's system at Ortonville, Minn. Arrangements will also be made to connect with Iowa points.

A telephone line will be built between Bethlehem, Ia., and Russell, in the spring.

Farmers in the vicinity of Whitter, Ia., have formed a telephone company and will connect with Springville and Viola.

The Fort Dodge Telephone company will be formed at Fort Dodge, Ia., to put in a telephone exchange.

An ordinance has been introduced in the council of Duluth, Minn., fixing rates to be charged by the Duluth Telephone company for the remainder of its franchise at $25 per year for business houses and $15 for residences, and providing that the company must supply any instrument ordered within 30 days after the application has been filed. If the company fail to file an acceptance of the ordinance within 10 days after its passage, it is provided that all telephone wires running along any street for more than 500 feet shall be removed to the adjacent alley.

Telephone connection will be made this spring between Langdon, N. D., and Grand Forks.

The Eau Claire Telephone company of Eau Claire, Wis., expects to have 200 instruments in by April 1st. It has orders for 500.

The Chariton and Newbern Telephone company is an applicant for a franchise at Lacona, Ia.

Independent Movement in North Carolina.

H. P. Strause, J. H. Bridgers and F. C. Toepleman of the Henderson Telephone company, Henderson, N. C., have just effected the purchase of the Newbern telephone system. The new company will assume active control of the property on May 1st. Mr. Strause says his company will expend several thousand dollars in improving the property. Mr. Toepleman, general superintendent of the company, will have the property placed in first-class condition at that time. He says the company will put in new switchboards, cables, instruments, etc.; in fact give Newbern an up-to-date telephone system.

The Henderson Telephone company now has exchanges in operation at Henderson, Louisburg, Oxford, Warrenton, Franklinton, Kitterell and Youngsville, with 20 toll stations at intermediate points, connected by upwards of 300 miles of toll line.

Mr. Toepleman hopes by August 1st to have exchanges in operation at Littleton, Weldon, Enfield and Halifax, and to connect them by all metallic lines with plants now in operation.

The officers of the Henderson Telephone company are: President, N. P. Strause; vice-president, T. T. Hicks; secretary, J. H. Bridgers; treasurer and general manager, H. P. Strause, and electrician, F. C. Toepleman.

Southern Telephone News.

Articles were filed with the secretary of state at Frankfort, Ky., March 21st to consolidate into one new corporation the Cumberland Telephone and Telegraph company and the Great Southern Telephone company, the capital stock to be $3,000,000. It is intimated that this is the first step in preparation for a rate war in Kentucky between the new company and the Ohio Valley Telephone company.

At Osceola, Ark., local capitalists have organized a company for the purpose of putting up a local exchange and long-distance lines. The wires are up and the telephones ordered for the exchange, and they will be in operation within 30 days. The company is known as the Osceola Telephone company, and has the following-named officers: President, William J. Driver; general manager, Thomas G. Brewer; secretary and treasurer, R. E. Fletcher.

Interior Telephones.

It would seem as if the use of interior telephones was a novelty in many large cities, judging from the attention that is being paid to the installation of an intercommunicating system in a large establishment in Boston. An eastern paper says: It is announced in Boston that Messrs. Paine, Weber & Co. have just moved into new banking offices at 27 State street, occupying the whole first floor of the new Brazer building, and that "among other conveniences are 22 sets of telephone instruments, comprising the regular local and long-distance sets, the stock exchange telephones and an interior system whereby each desk has telephonic communication with every other desk in the office."

In Chicago the use of telephones for connecting the several departments of large institutions has long since ceased to be a novelty. The Western Electrician introduced one of these systems when it moved into its present quarters, and in many of the large mercantile houses branch exchanges have been established by the Chicago Telephone company. Most of this business, though, is done by the independent companies and has no connection with the exchange system.

COMMUNICATION.

Firman Switchboard Patent Sustained.

To the Editor of the Western Electrician:

The Circuit Court of the United States for the Northern District of California has handed down a decision sustaining the Firman patent, No. 252,570, of January 17, 1882, which is the fundamental multiple switchboard patent. The defendants are the Capital Telephone and Telegraph company and its officers of Sacramento, Cal., who were the first of the opposition concerns to install a multiple switchboard. The court (Judge De Haven) ordered an injunction and an accounting against defendants.

BARTON & BROWN.

Chicago, March 30, 1898.

The Saginaw Valley Telephone company is extending its system in Saginaw, Flint, Bay City and East Bay City. It has put in an underground system and is now putting in new instruments and switchboards. The American Electric Telephone company of Chicago has secured the order for 3,000 new instruments for this system.

Western Electric Fans.

The Western Electric company's desk, bracket and ceiling fan motors are made for 110, 220 and 550 volts, and are so designed that on a 500-volt circuit three 110-volt motors or two 220-volt motors may be operated in series with perfect safety to the motors, and the 500-volt motor can be operated on a 600-volt circuit continuously without injury. All of these motors are wound for three speeds and are made with self-oiling and self-aligning bearings.

On the desk and bracket motors the switch is placed in the base of the motor, whereas in the ceiling fans it is placed in a neat switchbox on the under side of the motor casing. The desk and bracket motors are made in two sizes, the blades measuring 12 and 16 inches in diameter. They have four wings, it having been demonstrated that a four-blade fan is much more efficient than one with six blades. The current consumption of the 12-inch motors is much less than any 16 candle power incandescent lamp on the market, while the current consumption of the 16-inch motors is but a trifle more than that required for the ordinary 16 candle power lamp. The energy required by the 220 and 550-volt motors is practically the same as that required for the 110-volt motors. One very desirable feature is the facility with which the motors can be disconnected from the base and inserted in the bracket. The guard of the motor is made in a most durable manner and is firmly fastened in the motor, which prevents it from jarring. These motors are finished in polished brass, nickel-plate or black enamel without additional charge.

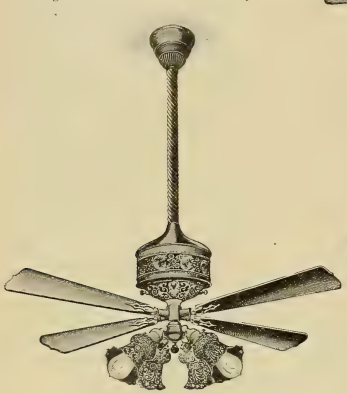


Fig. 3.

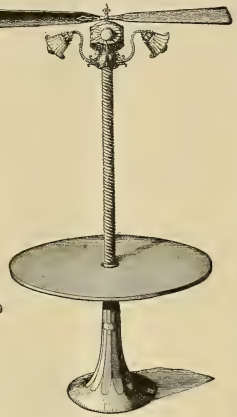


Fig. 4.

WESTERN ELECTRIC FANS.

All ceiling fans are so made that chandelier attachments can be readily put on, every motor being wired ready for the sockets, the lead wires being coiled in the top of the switchbox when not in service. The standard fan consists of four blades, 60 inches in diameter (each 8½ inches wide, and runs at 175 and 18[illegible] revolutions per minute. If desired, motors will be furnished with two blades, running at 210 and 215 revolutions per minute. These fans take but a trifle more current than that required for an ordinary 16 candle power lamp. All motors are furnished with self-oiling and self-aligning bearings and are perfectly balanced. The stems, from which the motors are suspended are usually adapted for 12-foot ceilings. These motors are finished in polished brass, oxidized copper or nickel-plate without additional charge. When ordered, motors will be furnished with one speed, these being made without the switchbox and the speed-controlling parts.

The column fans have but two speeds, 150 and 175 revolutions per minute, and are made with or without polished red birch tables, all metal-work being finished in polished brass or oxidized copper. The motors are furnished with a switch, while the lights are controlled by a switch placed on the under side of the table. The tables can be furnished either square or round and are four feet in diameter.

Special attention is called to the Tuerk alternating-current fan motor, which is furnished with two blades and is designed to be operated on a current of 60, 125 or 140 cycles, at 52 or 104 volts. This motor will be furnished finished in bronze, bowerbarff, nickel, brass or white and gold. All shafts are mounted on self-oiling bearings. A switch is provided for starting and stopping the motors. By a very ingenious device the angle of the blades may be so shifted that the wind may be blown downward towards the floor or upward towards the ceiling. The motors are of the reduction type. A reduction in speed is obtained by the introduction of leather-faced friction wheels, by means of which the motors are rotated at a slower speed than that of the armature; this device enables the use of a highly efficient high-speed, alternating-current motor, obtaining all of the desired results of the slow-speed fan.

Fig. 1.

Fig. 2.

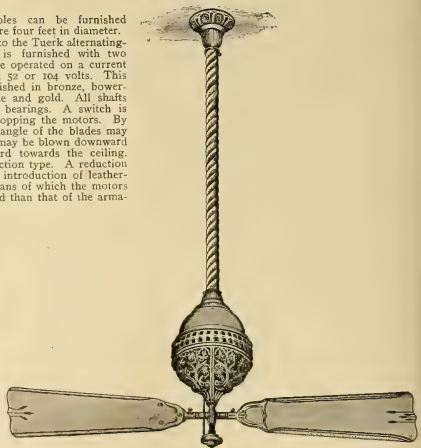


Fig. 5.

WESTERN ELECTRIC FANS.

A handsome catalogue has been issued describing in detail all of these motors and will be furnished upon application.

Referring to the accompanying cuts, Fig. 1 represents a front view of a 16-inch bracket fan motor; Fig. 2, a 12-inch desk fan motor; Fig. 3, ceiling fan with chandelier attachment; Fig. 4, column fan; Fig. 5, Tuerk alternating-current ceiling fan.

The village of Middleport, Niagara County, N. Y., has voted against an electric lighting system.

Municipal Ownership Abroad.

Robert P. Porter, writing in the Sun, says that a former article on the subject of municipal ownership and operation of street railways "has elicited so many letters asking for the entire case in favor of municipal ownership of such undertakings in England" that he prepared the brief statement of facts here given. He says:

"The experience of England up to that time was practically confined to six cities. The street railways of Liverpool had been in possession of the city for about three months, but the results so far were too meager to tabulate, and are not included in these tables. The financial results may be summarized as follows:

POPULATION AND LENGTH OF TRACK.

Name of city or town.	Population. census of 1891.	Length of track, miles.
Glasgow	393,920	77
Huddersfield	100,363	22
Leeds	402,419	28
Sheffield	347,278	10
Plymouth	98,121	4
Blackpool (a)	35,000	5
Totals	1,687,231	150

(a) A summer watering place, like Asbury Park; probably 100,000 population in summer.

PASSENGERS CARRIED AND CAPITAL INVESTED.

Name of city or town.	Number of passengers carried per annum.	Capital expenditure
Glasgow	100,000,000	$4,046,195
Huddersfield	4,308,269	700,000
Leeds	17,000,000 (a)	1,090,000
Sheffield	5,000,000	632,645
Plymouth	1,700,000	250,000
Blackpool	3,500,000 (a)	269,472
Total	131,508,269	$6,988,312

(a) Estimated.

MOTIVE POWER, DATE OF CITY ASSUMING OPERATIONS, RATE OF FARE.

Name of city or town.	Motive power.	Date of city assuming operation.	Rate of fare. cents.
Glasgow	Horse	July 1, 1894	1 to 6
Huddersfield	Horse and steam	1882	2 to 6
Leeds	Horse, steam and electric	1894	2 to 6
Sheffield	Horse and steam	July, 1896	2 to 6
Plymouth	Horse	1892	2 to 6
Blackpool	Electric	1894	4

REVENUE AND EXPENDITURE.

Name of city or town.	Revenue.	Expenditure.
Glasgow	$1,801,807	$1,393,210
Huddersfield	139,490	149,305
Leeds	312,555	285,476
Sheffield	(a)	(a)
Plymouth	37,615	18,566
Blackpool	48,027	45,140

(a) Detailed report for first year not available when I was in Sheffield.

SALARIES, PROFIT AND LOSS.

Name of city or town.	Amount paid in salaries and wages.	Profit and loss.
Glasgow	$632,000	$ 41,798 (a)
Huddersfield	80,000 (b)	306,013 (c)
Leeds	75,000	27,079 (d)
Sheffield		40,000 (e)(f)
Plymouth	13,825	25,000 (g)
Blackpool	15,000 (b)	936 (h)

(a) Annual profit to the common good, $41,798.
(b) Estimated.
(c) Total deficiency, met by the rates.
(d) Profit to the city in 1897 after deducting sinking fund.
(e) Excess of receipts on year's operation.
(f) The old company paid the city $50,000, and the excess of receipts over expenditures here shown is not profit on full investment of $632,645, but on what the plant cost the city, namely,

$133,828. The coming year we shall know more about this investment.
(g) Total deficit.
(h) Profit for the year.

"Having carefully studied the five exhibits, it will be seen that, though they are separate tables, combined they form a nearly complete statement of the results of the street-railway operation of these cities. Do these facts indicate that the English system is any better than the American system of private ownership? It would seem to me, after an examination of the data attainable, that the history and details of the various tramway enterprises in the United Kingdom are neither sufficiently extensive nor sufficiently satisfactory to point conclusively to any decision in favor of municipal operation of such untakings. Similar enterprises, when leased to private companies, both in Manchester and Liverpool, show far better results financially to the municipalities than the examples given above.

"Glasgow shows a profit of $43,793 to the city, with an investment of $4,046,195 (in a horse-car equipment put in during the last half of 1894), when an American firm stood ready to give the city a bonus of $250,000 and install an electric plant free of cost.

Huddersfield, in lamentable efforts to establish municipally operated railways, has muddled away $306,613 in deficits and has $700,000 invested in 22 miles of track.

"Leeds, a city of over 400,000 population, with 22 miles of track, may be said to have done fairly well, because it has not run behind; but does anyone in the United States believe a population of this size can really be served by 22 miles of street railway?

"Sheffield is making a beginning and wisely feeling out after the best system. The excess of receipts for the first year is no indication of what Sheffield will do when she has installed a system of 35 miles. The private company paid $20,000 a year into the city treasury, and has paid off for the city much of the original investment in track. The city thus fell heir to the whole plant for a song, and naturally shows a profit the first year. It would be strange if it did not. Those in control in Sheffield are in no sense prepared to underwrite municipal operation, at least until after an experience of 10 years.

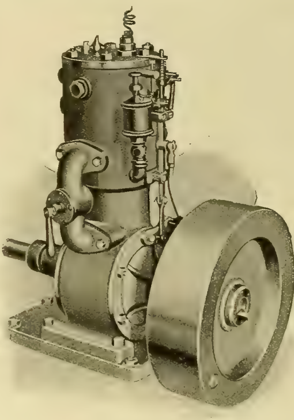
"Plymouth, a small affair, is behind $25,000, while the operation in Blackpool last year yielded a profit to that city of $936.

"Here we have the sum and substance of the municipally operated tramways in the United Kingdom up to date

"As an offset to these cities the attention of municipal-ownership enthusiasts is respectfully invited to the city of Boston, population about the same as that of Glasgow, miles of street railway, 452; Baltimore, population about the same as Leeds, street-railway mileage, 291, and lastly, if there is any city in the United States of 100,000 inhabitants not better supplied with rapid transit than Huddersfield and Leeds or a seaside resort on the Jersey coast that cannot beat Blackpool 10 to 1, I should like to have our municipal-operation friends name it. Here we have a population of 1,087,231, supplied with less miles of track than Washington, D. C., with a population of 250,000. Surely a study of the accompanying table is not calculated to attract the business man, anxious for practical transportation, toward municipal operation as a means of developing rapid transit. And yet we have here positively all the bedrock facts that can be given at the present time. The rest remain locked up in the imagination of those who talk so glibly of the 'strides' municipal ownership and operation are making 'on the other side, you know.'"

Mianus Gas Engine.

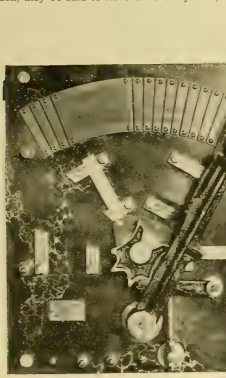
In the accompanying illustration is shown a 2½ horse power Palmer gasoline engine of the marine type, made by the Mianus Electric company of Mianus, Conn. The company manufactures complete gas or gasoline engines of from one to six horse power, both stationary and marine, and can supply the castings, parts and working drawings for the one horse power and 2½ horse power engines, for experimental purposes and for those who wish to construct their own engines. The engine is built on the two-cycle compression type, with an impulse at each revolution of the crank. The company also builds engines of the four-cycle type having an impulse at every other revolution. These engines are readily adapted to motor carriages and are also used for running printing presses and dynamos for electric lighting. They occupy but little space and consume a small quantity of gasoline or gas.



MIANUS GAS ENGINE.

Printing-press Controller.

The motor controller herewith illustrated is especially designed for the operation of printing presses. It is reversible, and is claimed by the manufacturer, the American Rheostat company of Milwaukee, to be an improvement over anything now in the market. This controller has a double-pole, reversing snap switch, which is operated automatically by the throw of the lever, opening the circuit when the lever is brought to central position, and closing the circuit when it is moved backward or forward. With this controller, sparking on the contacts is said to be done away with. The parts are easily accessible and renewable and of first-class material and workmanship. The instrument gives a variation of 12 different speeds on the forward motion and three on the backward motion, allowing the motor to reverse slowly. The company recently installed a large number of these controllers, and they are giving the best of satisfaction, as they prevent any possibility of damage to the motor through the carelessness of the operator.



PRINTING-PRESS CONTROLLER

Cosmopolitan Electric Company's Plans.

Promoters of the Cosmopolitan Electric company of Chicago have taken steps to form a construction company for the purpose of building a central-station and distributing system. The new concern will be known as the Cosmopolitan Construction company. It will be capitalized at $500,000 and will be composed of the men who are interested in the Cosmopolitan Electric company. The latter concern has purchased a site at Grove and Twentieth streets for the power house which it will build. It is now furnishing current from a temporary plant. The management announces that solicitors are now engaged in canvassing for business on the South Side.

The council of Duluth, Minn., has reconsidered its determination to purchase or parallel the electric-light and power plant immediately, and referred the resolution to that effect to a committee with instructions not to report until further orders. The council also voted to force the collection of a judgment for $12,000 which the city held against the street railway if the latter did not in six months accept the terms of paying $1,000 per month.

Telegraphic Communication with Cuba.

The telegraph companies are getting ready to meet the extra demand at southern points which a war with Spain would occasion. Telegraphic facilities will be arranged at Florida that will put Havana in direct communication with all cities in the United States. At the main cable station on the line between Havana and this country, heretofore, all matter from Havana has been relayed, but now single, duplex and quadruplex repeaters will be put in to connect with Havana, thus giving direct communication with all cities in this country. Should an American army be landed in Cuba repeaters will be placed at Havana, and Washington would be in direct touch with the army, in whatever part of the island it might be.

CORRESPONDENCE.

New York Notes.

New York, March 28.—The rapid-transit situation has many elements of interest but does not advance toward a solution. It is reported that the Manhattan Elevated directors have practically decided not to accept terms on the basis of the franchises recently offered the company by the Rapid Transit Commission. The directors claim that the company would be a loser if it undertook the extensions and paid the city the proposed rentals. The commission has its own troubles, too. It held several meetings last week, but as one member is in Europe and the mayor and controller, who are members, are opposed to the policy of the majority, the six votes necessary to adopt the "detailed certificates" of franchises to be presented to the Manhattan company could not be obtained. However, it is stated that the president of the board has in his possession the resignation of Charles Stewart Smith, the member who is now in Europe. The board has the power to fill its own vacancies, and, consequently, Mr. Orr has it in his power to declare Mr. Smith's position on the board vacant, on which the board may elect a successor immediately and in this way obtain the requisite sixth vote. Mr. Orr explained to his colleagues that the resignation had been placed in his hands by Howard C. Smith, to be used if necessary, but that he (Mr. Orr) hoped that as Charles Stewart Smith would be back in New York by April 6th it would be unnecessary to accept the resignation. In the meantime, it is said, irrespective of the Manhattan's action, the commission will proceed with its underground scheme. Every detail preparatory to the advertising of the contract is now nearly finished, and as soon as the order of the Appellate Division is entered steps will be begun to obtain bidders for the work of constructing the tunnel. Mr. Croker has declared war on the Rapid Transit Commission. He says that it is wedded to underground transit and that there is no hope for that system. Tammany, he asserts, would give the people real rapid transit. The mayor takes this view, too, and has expressed his opinion with vigor. Senator Ellsworth has introduced a bill in the State Senate to abolish the existing commission, but it does not appear likely that it will ever become a law.

The government has awarded a contract for more than 100 miles of telegraph cable. This is said to be the largest order ever placed by the government. It is given to the Safety Insulated Wire and Cable

company of this city. Sixty-five miles will be submarine cable and 35 miles will be underground cable. The order is given for the purpose of connecting all the forts and islands in New York harbor, so that in case of war immediate and direct communication can be had between the forts. It is understood that one cable will be laid under the water from Sandy Hook to Fort Hamilton, touching at Fort Wadsworth and Fort Lafayette. Another cable, connecting with this one, will be laid to Governor's Island. At this point the underground cable will come into use and be laid through a certain section not yet selected—it is said to Whitestone and Willett's Point—to connect with Fort Schuyler. As soon as the work is begun, which will be in a few days, it will continue night and day until completed.

A certificate of the lease of the Second Avenue railroad to the Metropolitan Street Railway company has been filed with the secretary of state at Albany. The terms of the lease are that the Metropolitan Street Railway shall control the lines of the Second Avenue company during the unexpired term of the company's charter in consideration of the payment to it of an annual rental of eight per cent. on the par value of its capital stock for the three years commencing March 1, 1898, and nine per cent. yearly for the remainder of the term of the lease. The certificate of lease is signed by Pierre Joy, president, and H. E. Doremus, secretary of the Second Avenue Railroad company, and H. H. Vreeland, president, and Charles E. Warren, secretary of the Metropolitan Street Railway company.

For the public celebration of the new city charter, arranged for May 4th, striking electrical effects are planned. It is proposed to arrange searchlights along Broadway in such a manner that the rays of light from them will extend up perpendicularly. There will be similar displays along important thoroughfares in Brooklyn, and in the other boroughs, and special displays of fireworks will be made at Prospect Park, Central Park, Fort Green, Jamaica, and at points in Richmond and the Bronx not yet decided upon. There will be prizes for street illuminations and house decorations. M. S.

Canadian Intelligence.

Ottawa, March 26.—The Canada General Electric company is supplying three small direct-connected units for the Canadian Pacific Railway steamships on the Stikine River. These machines will be of four kilowatts each, direct-connected to vertical engine of special type, running at 600 revolutions per minute.

There is a good deal of favorable comment on the kindly action of the Royal Electric company of Montreal, in coming to the assistance of the Lachine Rapids company, whose power house was burned during the first part of the present month. The Royal lighted Westmount and Mile End for its competitor, without charge, for several days.

The Electric Reduction company of Buckingham, Que., has placed an order with the Canada Electric company for a 1,000 horse power revolving-field generator, to be used for electrolytic work. The machine will be similar to those installed at Lachine, in the province of Quebec, and also in West Kootenay, B. C., except that the current will be applied at the low potential of 75 volts.

The Welland, Ont., Aqueduct and Power company has been organized with a capital of $25,000, to supply electricity for light, heat and power.

The Toronto Electric Motor company and the Thompson Electric company, Hamilton, have amalgamated, and the change took effect on the 15th inst., under the name of the "Toronto Electric Motor company, limited." The Hamilton factory will be moved to Toronto, and will occupy new buildings, which the company is to furnish by the first of May ensuing. The new shops will be of the most modern type, with traveling cranes, etc. With this change the new company will be in a position to do the heaviest work in power apparatus as well as in arc and incandescent of all kinds.

Engineer Leyden of the Cataract Power company has submitted to the city engineer of Hamilton, Ont., a proposition for running the sewage-disposal works by electric power, but at present it is not known whether his scheme will be adopted.

The Court of Appeals, at Toronto, has given judgment on the appeal by the Toronto Street Railway company against the assessment by the city of the poles, wires and rails of the company for the purposes of taxation. The court decided against the company, confirming the assessment, which had been already confirmed by the county judge. The assessment is for $537,000, which, at the rate of 17 mills, will net the city about $9,000 annually.

A. V. W.

PERSONAL.

G. H. Jay, of the Boston and Great Falls Electric Light and Power company of Great Falls, Mont., is in Chicago.

Reuben Fra[illegible], [illegible], president of the Columbia City Railway company of Washington, died at his residence in that city March 23d, at the age of 60. He was a native of Maryland, but removed to Washington 30 years ago, and had long been identified with the business interests of the city.

Josef Hofmann, the distinguished young pianist, who has created a veritable furore in the musical world, is said to be greatly interested in electrical science, with a turn for mechanical invention also. He has a laboratory in Berlin and has experimented with batteries, telephones and incandescent lamps. A horseless carriage is also building in Berlin from Mr. Hofmann's designs.

A writer in the English Iron and Coal Trades Review makes this interesting comment on a great man's tastes: "The question has sometimes been asked, Why has Sir Henry Bessemer only received a simple knighthood in recognition of his great services to the constructive and manufacturing industry of the country, while Lord Armstrong got a peerage, and Whitworth, Bell and others were honored with baronetcies? I am in a position to state that the proposal was once made to give the late illustrious inventor a peerage, and he declined it. He was a man of simple tastes and habits, and he did not like the idea of accepting a position which, to his mind, would more or less have changed those habits, and placed him in a social stratum to which he had been unaccustomed, and for which he had no taste. But if he had indicated the least disposition to move higher up in the social scale, the chance was open to him, through both Mr. Gladstone and Lord Rosebery."

ELECTRIC LIGHTING.

Williamsport, Md., has voted in favor of lighting the streets by electricity.

The city of Oakland, Md., has voted favorably for the issuance of $25,000 of bonds for the erection of an electric-light plant and the repair of the streets.

The village of Charlotte, near Rochester, N. Y., has decided by a vote of 63 to 24 to establish an electric-light plant at an expense not to exceed $10,000.

The city of Fitzgerald, Ga., has voted for the issuance of bonds amounting to $30,000 for the purpose of constructing waterworks and erecting an electric-light plant.

The city of Ocala, Fla., has recently decided, through its council, to become itself the owner and operator of its electric-lighting plant. The plant now in use is owned by the General Electric company, and the company is willing to dispose of it to the city. But a committee of the council, authorized to employ an expert to examine the condition of the plant, reports unfavorably to the city buying it, and favors the submitting of plans and specifications and the advertising for bids for a new plant.

The Rochester Gas and Electric company has given the Rochester Trust and Safe Deposit company a mortgage of $300,000 to fund the floating debt of the company and for other purposes. The property on which this mortgage is given is already covered by a mortgage of $2,225,000. It covers all the franchises, real estate, gas and electric plants, machinery, apparatus, wires, poles and mains, as well as a number of shares of capital stock in the Brush Electric Light company. The mortgage covers near 19 typewritten pages. It states that at a meeting of the directors held on March 26th the mortgage was agreed upon because "for the purpose of funding the floating debt of the company and of raising money for other corporate purposes, it is advisable to issue bonds of the denomination of $1,000 and numbered from 1 to 300, to bear date March 15, 1898, to be payable March 15, 1918, in gold coin, with interest at five per cent., payable semi-annually on March 15th and September 15th, in each year in gold, the company reserving the right to retire the bonds on March 15, 1902, or on any interest date after that time."

ELECTRIC RAILWAYS.

The Utica (N. Y.) electric railway is to extend its lines to Rome.

The Philadelphia Record says of the proposed $2,000,000 electric railway to Atlantic City, for which surveys have been completed, that it will have as an important feature an elevated steel road across the meadows.

The county commissioners of Cumberland, Md., have granted to the Frostburg and Lonaconing Electric Railway company and the Lonaconing and Westernport Electric company franchises to construct a railway line from Cumberland, Md., to Westernport.

At the recent meeting of the directors of the New England Railroad company the principal matter discussed referred to the extension of the third-rail system to Bristol, Conn., and action toward the furtherance of the project was taken. A director said that the third rail to Bristol will be in operation by June 1st.

American superiority is acknowledged in Korea, where a contract has been awarded by a company formed in the city of Seoul for operating electric street railroads through the principal thoroughfares, with American contractors for its construction. Consul general Horace N. Allen, in his report to the State Department, says that the company known as the Seoul Electric company, has an exclusive franchise, and has paid in about one half of the capital of $300,000. H. Collbran of Denver will construct and equip the road, which will be six miles in length. He has received a cash payment of $100,000 with his contract and the work will be rapidly prosecuted. It is regarded as a profitable enterprise. At present all the financial ventures of importance in Korea are in the hands of Americans.

To all appearances Buffalo is to have a new suburban railroad, as the Buffalo Valley Railroad company has been incorporated to build a line from that city to the village of Java, in Wyoming County, 27 miles away. The company is capitalized at $350,000, divided into 3,500 shares, all of which are taken, and it looks as though the majority of the stock is owned by capitalists who are also the owners of the Pennsylvania Steel company of Steelton, Pa. The route of the proposed road covers the largest tract of land about Buffalo not yet entered by an electric road. It is a rich country, and the line will connect with the Buffalo Railway company's system. The proposed route carries the tracks three-quarters of a mile north of Gardenville, touching the north side of the village of Elma, then, about two miles east of that town, turns from east to south-east and passes about a mile to the west of Marilla, goes through Porterville, Wales Center, Wales Hollow, crosses the Erie county line into Wyoming, passes through Strykersville and ends at Java. George A. and C. W. Ricker are the engineers.

TELEPHONE.

Dr. W. H. Walters is interested in a telephone system to be constructed at Pocomoke City, Md.

Colonel Henry P. Farrow is perfecting plans for the construction of a telephone system from Gainesville to Dahlonega, Ga.

At Moultrie, Ga., J. F. Monk, W. H. Barber and others have received a franchise for the construction of a telephone system and will incorporate a company for the purpose.

POWER TRANSMISSION.

A dispatch from San Francisco says that Prince Poniatowski is at the head of a company which purposes, within a year, to bring at least 10,000 horse power from the waters now running to waste on the western slope of the Sierra Nevada Mountains, in Alpine, Amador and Calaveras counties, by means of an electrical line 110 miles in length, to that city. A system of canals will convey the water to the point of its conversion into electrical power, and the current will be conveyed across San Francisco Bay at an elevation of 325 feet over the shallow waters opposite San Leandro. The cost of the plant is estimated at $1,000,000.

ELECTRICAL SECURITIES.

The Mexican Telegraph company has declared a quarterly dividend of 2½ per cent., payable April 13th.

The Westinghouse Electric and Manufacturing company has declared a dividend of 1¾ per cent. on its preferred stock.

The Edison Electric Illuminating company of Brooklyn has declared a quarterly dividend of 1½ per cent., payable April 15th.

The transfer books of the American Bell Telephone company closed on April 1st, and no more transfers of stock will be made before April 14th, upon which the dividend of $3 a share, payable April 15th, will apply.

The Cincinnati Street Railway company will issue $656,000 new stock, giving the stockholders the privilege of subscribing for the new issue at par. The allotment will be four per cent. The outstanding capital is $16,400,000 and the authorized capital is $18,000,000.

The Consolidated Traction company of New Jersey reports gross earnings for February of $221,646, net earnings of $104,451, fixed charges $115,477 and deficit of $11,026. For the two months ended February 28th the deficit was $4,111, as against $21,332 for the corresponding period of last year.

The North Shore Traction company reports gross earnings for February of $83,856, a decrease of $2,889 as compared with the same month of last year, and net $8,371, a decrease of $23,161. For the two months ended February 28th the gross earnings were $182,720, an increase of $2,270 as compared with the corresponding period of last year, and net $42,852, a decrease of $13,155.

Among the securities recently listed on the Pittsburg Stock Exchange were $9,725,000 of United Traction company 5s, due 1997; $3,000,000 of United Traction company preferred stock and $17,000,000 of United Traction common stock. The par value of the stock is $50. Some trading has been done in the stock since it was placed on the market, the common selling at 9¾ to 10 and the preferred at 40 to 40⅛. The bonds have been traded in moderately at 102 to 102¼. The preferred stock is guaranteed a dividend of five per cent. annually. The company's net earnings for the eight months

ended February 28th were $525,252, against $429,636 last year, an increase of $85,616. The fixed charges for the year 1898 are $386,422, leaving a surplus of $138,829.

The new and uncompleted Columbia and Maryland electric railway, between Baltimore and Washington, known as the Boulevard line, has been sold at auction to the Baltimore Security and Trading company for $450,000. The property was first offered in three divisions, but as the total of the separate bids was only $335,000, the lump sum of $450,000 offered by the Baltimore Security and Trading company was promptly accepted. The road will be reorganized, but it is said will not be operated through to Washington for some time.

The Chicago Metropolitan "L" road reorganization scheme is being discussed, although it is probable that no decision has been arrived at by the committee. No announcement is expected while the Cuban trouble continues. A plan is being considered to reduce the bonds to $10,000,000, lowering the interest rate to four per cent., to make up the scaling of $5,000,000 in preferred stock, and to cut the common stock in half, leaving $7,500,000, and another proposition is to put the interest on a sliding scale, without reducing the bond issue, beginning at four per cent. and increasing it yearly as the road is able to earn the charges.

MISCELLANEOUS.

The American Range Finder company of New York has made an assignment to Charles B. Van Nostrand. The company was incorporated in 1888, with an authorized capital of $500,000, to manufacture the instrument invented by Lieut. Fiske to determine the distance and location of ships at sea. The instrument was adopted by the government for use on the cruisers Chicago and Baltimore.

A man who has "valuable and merchantable thoughts" at night tells a New York Sun reporter how he preserves them. "Formerly, before I went to bed, I used to put my idea pad, with a pencil by it, on a shelf in the adjoining room near a gas jet, left burning low, as I didn't want a light in my sleeping room. When an idea struck me I would get out of bed, go into the next room, turn up the light, make a note of it and go back to bed. But I didn't always do this. I wasn't what you would call lazy, but if it was a very cold night or I was very tired I would say to myself that I thought I could remember that, and so I would take the chances, and then every time I would forget it. I don't know how much money I lost in this way, but a good deal. But now I have a little table at the head of the bed with the pad and pencil on that, and hanging down over it an incandescent electric light. I don't have to get out of bed at all. I have only to turn the key of the shaded light, pick up the pad and jot down the idea. Then I put the pad down on the table again and turn off the light."

TRADE NEWS.

Twelve Westinghouse engines, driving the electric-lighting plants on the new line of Yukon River steamers which are building by the Moran Bros. company at Seattle, Wash., will assist in dispelling the darkness of the long Arctic nights next season.

The Buckeye Electric company is having a good demand from central stations for its special anchored filament 220-volt Buckeye incandescent lamp. The special filament used is said to deliver full 16 candle power for 600 hours, where pressure does not exceed normal. This means profit to both stockholder and patron.

Secretary A. C. Garrison of the Columbia Incandescent Lamp company of St. Louis does not attempt to conceal his gratification at the fact that the business of the company shows an increase of more than 50 per cent. when the first three months of this year are compared with the corresponding period of last year. The Columbia company seems to have no trouble to hold its old business, and is very successful in securing new customers, who are placing large contracts. The trade outlook for this company is most promising.

The Western Electric company has recently opened a branch office at No. 10 Security building, St. Louis, in charge of Mr. Irvine S. Jackson, who will devote his entire attention to the business in that city and the surrounding territory. This office will be furnished with every convenience for meeting the large requirements of the trade, both as regard prompt delivery of goods and satisfactory prices. A stock of goods sufficient to meet the demand will be carried. The policy of opening branch offices is a new one with the Western Electric company, and it may be extended to other cities.

The Electric Ozone syndicate of London announces that it is now prepared to supply commercial ozone generators, made entirely of aluminum. The advantages of these improved apparatus are said to be that the yield of ozone is large (about 100 grammes per horse power hour), that there is no rise of temperature in the ozonizers which may damage them or cause a loss of ozone, that they can be worked in a continuous manner, and can be made of any size to produce from 100 grammes to 1,000 grammes and more per hour. The syndicate asks that those who are desirous of applying ozone in their works may let it know for what purpose and what approximate quality of ozone would be required per hour.

Under the title "Fan Motors," the General Electric company has issued from its press at Schenectady a well illustrated and beautifully printed pamphlet descriptive of its '98 fan motors for alternating and direct curents. In the introduction attention is called to the fact that the General Electric company has manufactured electric fans since the earliest days of the electric motor, and, in its '98 models, embodies the result of its long practical experience. Illustrations are given of the several styles, and each is accompanied by a clearly written and careful description. This pamphlet will be sent to any address on application to any sales office of the company or to the supply department at the principal office at Schenectady.

The Kinloch Telephone company of St. Louis, which is so widely known in telephone circles throughout the country, and which is composed of some of the very best business men of St. Louis, recently closed a yearly contract with the Phœnix Carbon Manufacturing company of that city for batteries and component parts. The Kinloch company from its incipiency determined to use only the very best material in construction and operation. After elaborate tests by the scientific men the company decided that the Phœnix No. 1 carbon porous-cup cell filled all of the requirements, and was the best for its purposes, hence the placing of the contract. The Phœnix Carbon Manufacturing company has made extensive improvements and largely increased the facilities, putting it in position to deliver batteries of this or any other type in any quantities that may be desired. The product in all departments is recognized as the best.

The Metropolitan Construction company is now doing all of the installation work of the Sprague Electric company. The announcement was made in a striking two-color circular by the Sprague company, in which it was pointed out that the Construction company would not only contract for installation and maintenance of Sprague machinery, but of any other machinery as well. The offices of the Consruction company, as well as those of the Sprague company, are in the Commercial Cable building, New York. The officers are W. D. MacQuesten, president and general manager, and Wallace E. Carver, treasurer. The organization of the Sprague Electric company, which was formed by the consolidation of the Interior Conduit and Insulation company and the Sprague Electric Elevator company, is being rapidly perfected. The offices of the company now occupy practically the whole of three floors in the Commercial Cable building. The company recently secured a suite of rooms in the Marquette building, Chicago, which will be in charge of Mr. Millard B. Kitt and Mr. E. B. Kittle, long identified with the company. Well known electrical men and houses are being rapidly secured to represent the Sprague company in various sections of the country, and the organization bids fair to be a remarkably strong one in every way. An advertising and press bureau is one of the new departments of the Sprague company, and it has been installed in a suite of rooms on the nineteenth floor of the Commercial Cable building.

BUSINESS.

The Triumph Electric company of Cincinnati reports a very satisfactory business and points to 95 orders for machines received since January 1st.

Gustave Monrath & Co. of Chicago and New York are doing the wiring for the large electrical plant in the Grand Central railroad depot in New York.

Sipe & Sigler of Cleveland, who are pushing the Willard storage batteries so energetically, have issued a little pamphlet which tells all about the Willard battery, its characteristics, uses and price.

George W. Patterson, the agent for the Gordon-Burnham batteries in the West, calls attention to the merits of these batteries, to the prices that are made on them and to the stock carried in Chicago.

This is the season when fan-motor catalogues flourish. A recent production of this description is that of the Holtzer-Cabot Electric company of Boston. This company manufactures direct-current fans for desks and ceilings. The motors are claimed to be elegant and efficient as well as economical, strong and durable.

The Safety Conduit company of Rankin Station, Pa., states that its "Loricated" electric conduits will be installed in the new United States appraisers' warehouse, New York, also in the Prudential building, Atlanta, Ga., the former building requiring in the neighborhood of 30,000 feet and the latter building over 50,000 feet of iron-armored conduit.

The new Bellfield Hotel, Pittsburg, Pa., will have its own electric light plant, consisting of three Ball engines, built by the Ball Engine company, Erie, Pa., direct-connected to Westinghouse dynamos. McNeil Bros. of Chicago have recently placed in their building a Ball engine, built by the Ball Engine company, Erie, Pa. The engine is direct-connected to a Western Electric company dynamo. The American Bank building, Kansas City, Mo., recently installed an electric plant. Two Ball engines, built by the Ball Engine company, Erie, Pa., direct-connected to the Western Electric company's dynamos, furnish the power.

J. H. Cooke, western representative for the Jandus (formerly Manhattan) enclosed arc lamp, reports inquiry from all parts of his territory from prospective purchasers of enclosed arc lamps. The Jandus 25-inch lamp, burning 150 hours on 12 inches of carbon, is a great favorite. A catalogue is sent on application. A stock of these lamps is carried at Chicago.

Eugene Munsell & Co., importers and wholesale dealers in mica, of 117 and 119 Lake street, Chicago, are sending to the trade a blotter, which is rather artistically gotten up and refers to the rapid growth of their business as being the strongest evidence of the superiority of their mica. They make a specialty of mica for stove and electrical purposes. A funny little man is illustrated as making quick delivery from a great stock of mica in a large city.

The Davis & Egan Machine Tool company of Cincinnati received a number of large orders last week through its office at Berlin, Germany. Among them was one from the Bayreuther Maschinen Fabrik at Bayreuth, near Dusseldorf, for a number of upright drill presses, radial drills, 36-inch lathes and bolt cutters. This customer is said to be the largest builder of electric cranes and hoists in Europe. An order was also received from the Locomotiv Fabrik Maffei at Munich, Germany, for a number of large engine lathes.

The recently patented Newgard waterproof receptacle and globe is finding a large field of usefulness in breweries, paper mills, packing houses, sugar refineries and all other places where moisture or fumes make the insulation of an ordinary lamp socket a difficult proposition. The price of this device is down to a point where it is said to be economy to use it in all places where high insulation is required. The Newgard receptacle and globe is so simple in construction and yet so clever in its conception that it commends itself to everyone at first sight. The Electric Appliance company is always glad to submit a sample of this globe where there is a possibility of its adoption.

The new catalogue of the Electric Gas Lighting company of Boston is an attractive production, with a cover printed in silver-bronze and handsome insert plates in colors. It gives a complete list of house-goods specialties. The well-known Samson battery receives due attention, and the new Nosmas battery is described as "the outcome of numerous inquiries made by electrical contractors for a battery that could be sold at a nominal figure and which will be capable of longer life and more even output than the many cheap carbon-cylinder batteries forced upon an already overcrowded market by American carbon manufacturers." The trade name of this battery can be kept in mind by spelling "Samson" backward.

The General Electric company, in view of the constantly growing demand for apparatus of its manufacture, has decided to make a large increase in its manufacturing facilities. On March 25th the company placed contracts for the construction at its Schenectady works of a new foundry, which will be one of the largest in this country. The present foundry has been for some time entirely inadequate to the demands upon it, and considerable work has been passed on to the admirably equipped foundry which the company has at Lynn. The work to be done has, however, grown even beyond the capacity of both the Lynn and Schenectady foundries, working overtime, and all is now to be concentrated in the new foundry, construction of which is to be begun immediately. The building will be of brick, 500 feet long and 140 feet wide, with an "L" 100 feet by 120 feet.

The Philadelphia Electric Manufacturing company of Philadelphia has been obliged to extend its manufacturing facilities in order to meet the increase of trade which it has been enjoying for some time past. The factory now includes a second floor, from 2011 Market street, extending back to 2010 Commerce street, giving over 4,000 feet of floor space. The company has added a large amount of machinery and experienced help, and is now very busy in preparing for the demand for its ceiling fans, which will embody many excellent points. Particular attention will also be paid to the regular line of work, of arc cut-out boxes and clutches for arc lamps, together with segments in blocks, lamp boxes, magnets, carbon rods and holders, globe nets, carbon cups, etc., which will be manufactured in larger quantities than ever before.

The Marietta Manufacturing company of Marietta, Pa., has now completed its designs of ceiling fans for the coming season and offers them for the consideration of the electrical trade. This concern is under the management of D. H. Kulp, who for many years has been in this line of business, and is proficient in the knowledge of what is necessary to secure the best results in the manufacture of ceiling fans. The fans are built under patents which have been issued to Mr. Kulp. Information can be secured by addressing the company for its new circular matter, which is now ready for distribution, giving full details in regard to its ceiling fan. The Marietta Manufacturing company occupies a large

building, which is fully equipped with modern machinery and tools especially built for the manufacture of the product, and the company guarantees that nothing will be left undone to make its ceiling fans the best in the country.

The Morse Wool Treating company has just completed at Norton, Mass., an extensive plant for purifying wool. The buildings are of a substantial character, entirely fireproof, and were designed and built by the Berlin Iron Bridge company of East Berlin, Conn. The floors throughout the whole plant are of beams and corrugated iron arches, to carry the excessive loads common to warehouse construction. The roofs are of the Berlin Iron Bridge company's patent anti-condensation corrugated iron. The Berlin company has the contract for building a new power house, car barn and steel bridges for the Port Jervis Electric Railway company at Port Jervis, N. Y. The buildings will be of a very substantial character, entirely fireproof, and will also be covered with the company's patent anti-condensation corrugated iron. The bridges are plate-girder type, constructed in a substantial manner for carrying the heaviest loads.

The fiscal year of the Brush Electric company ended January 31st. It reports that it shipped a larger amount of Brush arc apparatus during the last 12 months than in any previous year in its history. Considering the fact that the first Brush arc dynamos were sold in 1880, more than 20 years ago, it is remarkable that the Brush arc system to-day is as successful as ever. A large portion of the business during the last year has been in connection with the sale of large Brush arc dynamos which have given universal satisfaction. Some of the largest electric-light stations in the country have disposed of all of their smaller arc dynamos of different types and adopted the large Brush arc dynamo as their standard. The following list indicates what the Brush company has done in this line since the company began to manufacture these dynamos: Brooklyn (Citizens') 3,360 lights capacity, Brooklyn (Municipal) 1,200, Newark 3,000, Cleveland 1,800, Philadelphia (Brush) 1,500, Philadelphia (Northern) 1,300, Buffalo 4,250, Worcester 1,000, Toronto 900, Quebec 625, Harrisburg 750, Erie 750, Albany 500, Troy 500, Paterson 625, city of Chicago 700, John Wannamaker 625, Carnegie Steel company 500, United States Electric Lighting company, Washington, 1,000; Edison Electric company, New Orleans, La., 2,250; United Electric Light company, Malden, Mass., 720; Manchester Electric company, Manchester, N. H., 500; Reading, Pa., 500; Boston, Mass., 660; Kings County Electric Light and Power company, Brooklyn, N. Y., 625; Cambridge Electric Light and Power company, Cambridge, Mass., 720; Rockford, Ill., 625.

ILLUSTRATED ELECTRICAL PATENT RECORD.

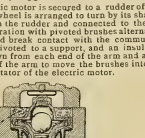
Issued March 22, 1898

600,866. Electrical Alarm Gauge. John Hackney, Norfolk, Va. Application filed June 24, 1897.

An electrically actuated alarm circuit has one pole in electrical connection with the movable hand of the pressure gauge, and the contact point forms the opposite pole of the circuit, and is mounted in the non-conducting sleeve fixed in the gauge-case, so as to be rotated on its own axis and having its recessed end arranged to be projected into or withdrawn from the path of the indicator end of the hand.

600,874. Electrical Device for Propelling Boats. Lyman R. Jones, Boston, Mass. Application filed July 2, 1895.

An electric motor is secured to a rudder of a boat, and a propeller wheel is arranged to turn by its shaft in suitable bearings in the rudder and connected to the electric motor for operation with pivoted brushes alternately arranged to make and break contact with the commutator, an arm centrally pivoted to a support, and an insulated pin projecting down from each end of the arm and adapted in the swinging of the arm to move the brushes into contact with the commutator of the electric motor.



NO. 600,937.

600,890. Trolley Wheel. Elbert R. Robinson, Chicago, Ill. Application filed November 28, 1896.

A flanged grooved wheel having within its peripheral groove a lining with lateral offsets integral with the filling, and the conducting rings at the ends of the hub electrically connected with the offsets.

600,896. Pneumatic Controlling System for Electric Cars. Sidney H. Short, Cleveland, Ohio. Application filed September 20, 1897.

In a pneumatic controlling system for electric cars there is a train of several cars, propelling motors mounted on two or more cars, a motor controller mounted on each motor car, and pneumatically actuated means for simultaneously operating all the controllers throughout the train, and means mounted on each car for controlling the pneumatic actuating means.

600,937. Electric Contact Box. Joseph N. Thomas, Johnstown, Pa. Application filed September 18, 1897.

The method of interrupting an arc which may be formed between the terminals of a switch by the regular current consists in utilizing the heat developed by the arc to melt a fusible portion of the circuit and thus open the circuit to one of the terminals.

NO. 601,023.

600,941. Magnetic Clutch and Power-station System. Bion J. Arnold, Chicago, Ill. Application filed June 20, 1898.

The first claim is appended: The combination of a driving shaft with two power transmitting shafts, said power transmitting shafts located at one end of said driving shaft, one surrounding the other, power transmitters adapted to be operatively connected one with each of said power transmitting shafts, and a driving-connection device associated with each of said shafts whereby either of said power transmitting shafts may be separately and independently connected with the driving shaft.

600,966. Damper Governor. Charles Kummer and Lewis Bertrand, Easton, Pa. Application filed May 4, 1896.

Features of this invention are: an electrically operated damper, a shaft and a damper mounted thereon, a cam plate mounted on the shaft, and magnets mounted adjacent to the shaft, an armature adapted to operate in connection with the magnets, a vibrator adapted to open and close the electrical circuit, a ratchet wheel mounted upon the shaft, a pawl mounted upon the armature and adapted to engage the ratchet wheel, a pawl detent mounted on the casing and adapted to engage the ratchet wheel, brushes adapted to bear upon the plate, binding-screw adapted to engage respectively the brushes, the parts operating in combination with a thermostat, battery and suitable conductors.

600,969. Electric Circuit-closing Device. George Newman, El Paso, Texas. Application filed September 27, 1897.

An electric circuit-closing device having in the face exposed to view and contact a recess, and in the recess a plate of transparent material coated on the under side with luminous or phosphorescent paint, the recess being so configured that the paint is maintained out of contact with the surface of the recess.

600,981. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Application filed December 7, 1897.

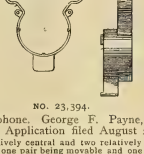
Two current-measuring instruments are attached to a single or common base and have their indicating needles so located with relation to a common scale that independent readings may be taken at the same instant.

600,982. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Application filed December 7, 1897.

This instrument has the movable coil either partially or wholly immersed in a dampening liquid.

600,983. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Application filed December 7, 1897.

The instrument described has its stationary energizing coil wound upon two spools, in combination with a movable coil pivotally supported within the magnetic field between the adjacent ends of the spools and an index hand carried by the shaft of the movable coil, all of the parts being supported or suspended beneath the lid of the inclosing casing.



NO. 23,394.

600,990. Telephone. George F. Payne, Philadelphia, Pa. Application filed August 21, 1897.

Two relatively central and two relatively lateral electrode faces, one pair being movable and one rigid in the supporting frame, granular conducting material situated between the adjacent central and lateral electrode faces, a diaphragm and a positive connection between the two movable electrode faces whereby they are moved synchronously with the diaphragm and so as to simultaneously relax the pressure on one mass of granular material and increase it on the other mass.

600,991. Telephone Transmitter. George F. Payne and William D. Gharky, Philadelphia, Pa. Application filed September 11, 1897.

In a telephone transmitter there is the combination with the electrode box of the two movable electrode buttons and an actuating rod embodying two insulated conductors, one connected with each button.

601,023. Alternating-current Motor. Walter Langdon-Davies, London, England. Application filed November 15, 1897.

An alternating-current motor is described in which the starting coils are of numerous turns and relatively high self-inductance as compared with the running coils and in which a resistance is added at starting to the circuit through the running coils.

601,042. Battery. William Morison, Montclair, N. J. Application filed January 20, 1896.

A battery case is described consisting of a non-conducting material and provided with a holding plate, molded in the same, in combination with a friction spring bolster, the clamp and spring and means to hold the parts together.

601,168. Cluster Fixture for Electric Incandescent Lamps. Nelson Weeks, New York, N. Y. Application filed October 1, 1897.

An incandescent lamp fixture comprises a base having a contracted central portion and a split flanged contracted central portion, contact supports extended through each of the contracted portions, and a cap having a plurality of openings for the insertion of lamp bases to engage with the contacts.

601,172. Portable Camera for Röntgen-ray Photography. Gaston Peguy, Paris, France. Application filed March 23, 1897.

An induction coil and a battery or accumulator, a movable rod having a bevel, and a support carrying a Crookes tube, are employed to form an open circuit, which may be closed by adjusting the rod, the latter having a non-conducting head, which when not in use bears upon the interrupter, and in releasing the latter sets up its vibration.

601,195. High-potential Insulator. John W. Boch, East Liverpool, Ohio. Application filed February 1, 1898.

A high-potential petticoat insulator having a vertical tubular post of porcelain or equivalent material, secured to and supporting the petticoats of the insulator and having its lower end adapted to fit into an opening in the cross-arm and a metal fastening pin in the tubular post.

601,206. Brake for Electric Motor Cars. Patrick B. Hayes and Hugh M. Carbine, Chicago, Ill. Application filed December 23, 1896.

NO. 23,395.

Brake mechanism for motor trucks having duplicate motors is described, including the combination of a wheel-brake mechanism, duplicate auxiliary brake mechanisms for the armature shafts of the motors, and a pair of equalizing levers arranged at opposite ends of the truck and operated from the car platforms, such equalizing levers having operative connection with the wheel-brake mechanism and with the armature-shaft brake mechanisms.

DESIGNS.

28,394. Case for Electrical Measuring Instruments. Edward Weston, Newark, N. J. Application filed February 14, 1898. Term of patent 14 years.

The claim is for the design for a case for an electrical-measuring instrument as here shown.

23,396.

28,395. Electrical Instrument Case. Edward Weston, Newark, N. J. Application filed December 7, 1897. Term of patent 14 years.

Claim is made for the design for an electrical-instrument case as here shown.

28,396. Electrical Instrument Case. Edward Weston, Newark, N. J. Application filed December 7, 1897. Term of patent 14 years.

The design is for an electrical-instrument case as here shown is claimed.

Western Electrician.
EVERY SATURDAY.
Vol. XXII. CHICAGO, APRIL 9, 1898. No. 15

Virginia Hotel Plant.

An attractive electric-light plant in an attractive hotel is shown by the pictures on this page. It is the installation in the Virginia Hotel, at Kush and Ohio streets, and is a model isolated plant for cleanliness, roominess and airiness. The machines are painted white and striped with gold; there is plenty of light, air and head-room; everything is spotlessly clean and the brass railings are polished till they shine. Altogether it is a pleasing plant to look upon. An unusual feature for an isolated plant is the rope drive.

Four tubular boilers, made by Tobin & Hamler, 75 horse power engine and a 100-kilowatt machine by the 150 horse power engine.

The switchboard is ornamented in an unusual manner by two mirror panels, one on each side of the board proper. In the picture a reflection of the larger dynamo is shown in the right-hand mirror. The board is of marble framed in wood, and a brass eagle surmounts the whole with a pilot lamp in its beak. The instruments are of the Western Electric company's type.

From this board current is distributed to about 2,500 incandescent lamps in the hotel and also to two near-by private residences. Several motors are awarded to the Kupferle Bros. Manufacturing company, covers three 150 horse power water-tube boilers with down-draft furnaces, the Paul system of steam heating, two 300 horse power Hoppes feed-water heaters, boiler-feed, house and air pumps, and the complete system of pipework. The steam pressure will be 125 pounds.

The General Electric company secured the contract for electrical equipment, covering three compound Imperial engines of 120 horse power each, directly connected to three 75-kilowatt direct-current dynamos and speeded at 260 revolutions per minute. There will be about 600 16 candle power incandescent

Switchboard. Engines and Dynamos. Hotel Building.

VIRGINIA HOTEL PLANT.

supply steam for the heating, lighting and power plant of the hotel. They are equipped with Murphy furnaces and are 60 inches in diameter and 16 feet long. They supply steam to two Corliss engines, each of which drives a dynamo. The engines were built by Weisel & Vilter of Milwaukee, and are simple engines with Corliss valve gear, one of 75 horse power and the other of double the capacity. Direct rope transmission is used to connect the engines and dynamos, the tightening device being placed between the driving and driven pulley in each unit. Manilla rope seven-eighths of an inch in diameter is used, and there are nine turns on the pulleys of the larger unit and seven on the smaller. The dynamos are direct-current, six-pole, Western Electric machines of 115 volts. A 50-kilowatt machine is driven by the also operated. One, of 15 horse power, drives the machinery in the laundry; another, much smaller, operates a dish-washing machine, while four others are connected to ventilating fans.

Interesting Private Plant in St. Louis.

Contracts have been placed for the mechanical and electrical equipment of the large mercantile building now being erected on the north side of Washington avenue, between Ninth and Tenth streets, St. Louis, by the Commerce Realty company. This building has been leased for 10 years, beginning June 1st next, to the Hargadine-McKittrick Dry Goods company. The contract for steam equipment, which has been

lamps in the building and 400 long-burning enclosed arc lamps. The electrical plant will also furnish current for driving the entire elevator plant, the contract for which has been awarded to the Sprague Electric company of New York. This contract covers two passenger elevators, six freight elevators, one dumb-waiter and one ash-hoist. The distribution will be on the 220-volt two-wire system for all the different kinds of service. The elevators are to be run from the same generator units as the lighting system.

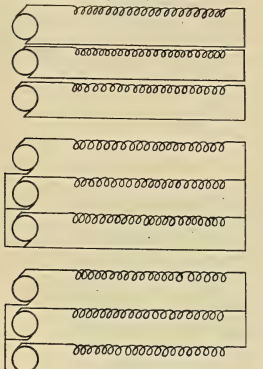
This installation represents a distinct advance in St. Louis in modern installations of this character, and its performance will be watched with interest. Eames & Young are the architects and have associated Bryan & Humphrey with them as consulting engineers.

Three-phase Machinery.

By William Mayo Venable.

The object of this paper is to present in simple form some facts about polyphase circuits, so that they can be understood by those electricians who have not the time or inclination to study the subject more thoroughly. The curves given, when not diagrams merely, show the results of actual tests on machines. However, they are introduced, not as data, but as illustrations.

If three alternating-current generators, supplying three separate circuits, as in Fig. 1, are connected together at one terminal only, the operation of the machines will not be affected. Such a connection merely brings the three terminals to a common potential, and does not affect the difference of potential between the two terminals of any one machine. There will, therefore, be but little effect on the operation of the machines if a common wire is run for all, as in Fig. 2. Now, if we can so arrange our circuits, and so construct our dynamos, that there will never



FIGS. 1, 2 AND 3. THREE-PHASE MACHINERY.

be any current in the common-return wire, we can dispense with that wire. This condition is fulfilled when the currents in the three remaining wires are 120 degrees apart in phase and equal in intensity.

Fig. 4 represents three sine curves 120 degrees apart. From this figure it is readily seen that the algebraic sum of the currents at any instant is zero. We have, then, the arrangement shown in Fig 3, and we need to run three wires only, instead of six, assuming that the loads in the three branches are equal, so as to eliminate any trouble from unequal losses in the different branches. The easiest way to keep the machines 120 degrees apart in phase is to make three machines in one, that is, to put three windings on one armature. Such machines are called three-phase machines.

A simple one can be made of a Thomson-Houston arc dynamo by bringing the terminal wires to col-

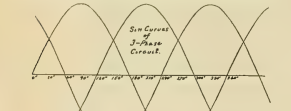


FIG. 4. THREE-PHASE MACHINERY.

lector rings instead of to the three commutator segments. The fields would have to be separately excited. Fig. 5 is a diagram of such a winding. The number of poles can, of course, be increased, just as in an ordinary alternator, increasing the frequency of alternations.

Having a machine thus wound with three coils, there are two simple ways of connecting the coils. One of these, known as the star connection, is shown in Fig. 6; the other, known as the mesh connection, is shown in Fig 7. In the mesh connection the potential between any two lines is the potential developed by one coil only. This connection is used when current for light or both light and power is to be supplied from the same generator, as it is not so apt to become unbalanced as the star connection. When the coils are connected in the star connection the potential developed between terminals is some what greater than in the mesh connection. This arrangement is used where the dynamo supplies current for power purposes only.

Thus a three phase circuit is simply an arrangement of alternating circuits, and follows the same laws as ordinary alternating circuits. But on account of the peculiar arrangement we are able to obtain phenomena which cannot be obtained with simple alternating currents. We are able to make a self-starting motor, without collector rings or movable contacts of any kind, thus getting rid of one of the most objectionable features of other types of dynamo-electric machines.

If two coils of wire are set at right angles to each other, with the intersection of their planes along a common diameter, as in Fig. 8, and these coils are supplied with alternating currents of the same periodicity, but 90 degrees apart in phase, the re-

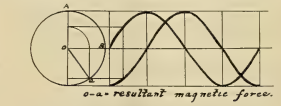


FIG. 9. THREE-PHASE MACHINERY.

sultant magnetic effect is similar to that of a magnet rotated about an axis perpendicular to its magnetism. In Fig. 9 the radius of the circle represents the resultant magnetic force, and rotates once each cycle, or complete double alternation. Now if we have three coils 120 degrees apart in phase, we have to compound three curves instead of two. The result is shown in Figs. 10 and 11. A ring of iron passed through the coils A, B and C would have a tendency to rotate. This tendency is greatly increased by winding the ring in a manner similar to the winding of the coils. Motors built on this principle are called rotary-field or induction motors.

The appearance of induction motors is familiar to all readers of electrical journals. The magnetic parts, both the stationary and rotating portions, are

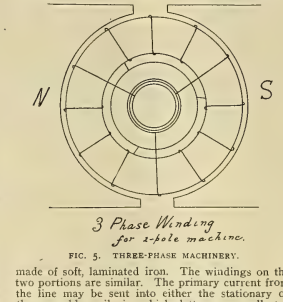


FIG. 5. THREE-PHASE MACHINERY.

made of soft, laminated iron. The windings on the two portions are similar. The primary current from the line may be sent into either the stationary or the movable coil, in which latter case collector rings must be provided. Sometimes the motor is made to perform as both motor and transformer, as in the railroad now being installed in Varse, Italy.

In its applications the inductor motor is as flexible, as simple, as easily controlled and as reliable as the continuous-current motor. It has certain advantages not possessed by the continuous-current machine, notably the absence of a commutator or sliding contact of any kind. Its use is, however, restricted to those localities where current can be obtained from either a two-phase, a three-phase or a monocyclic generator.

The starting torque of a rotary-field motor can be made very large if desirable, but it is usually slightly less than that of continuous-current motors of the same capacity, so that the motor may be most efficient when running at full speed. In stationary motors a resistance is frequently inserted in the secondary circuit during starting, but short-circuited when the machine has attained full speed.

The curves, Figs. 12, 13 and 14, show the general

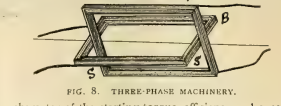


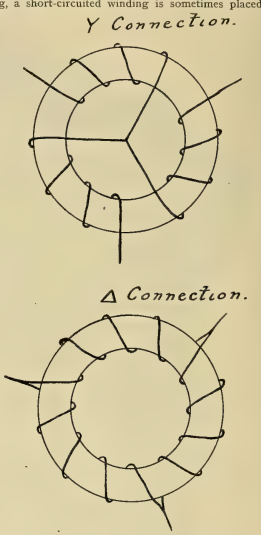
FIG. 8. THREE-PHASE MACHINERY.

character of the starting torque, efficiency and speed curves of certain experimental three-phase motors. These curves show the character of the machine only. They do not represent the excellence of any machines now on the market. The speed regulation of these machines is particularly interesting to the practical man.

The dynamo for three-phase transmission may be simply an ordinary alternator with a special armature. This armature has three sets of coils, 120 degrees apart in phase, and three collector rings. It is possible to compound these machines for constant potential, but for purposes of power transmission it is not necessary.

The self-starting synchronous motor is a motor which starts itself by induction, and runs at constant speed, with a separately excited field, when once started. The speed of a synchronous motor is determined by the number of alternations per second supplied by the generator. The motor itself is in all respects like the generator, and could be used as a generator if desired. In operating synchronous motors it is important to have the proper relation between the field strengths of the generator and the motors. If the field is too weak in the motor, the machine will take excessive current without developing the corresponding amount of power, but it will not change its speed as a continuous-current machine would, but will suddenly stop when sufficiently overloaded. If the field in the motor is too strong the machine will develop a potential higher than that supplied by the generator, and will stop when overloaded, because sufficient power cannot be given to it. If the field strengths of the two machines are properly proportioned, the synchronous motor will carry its load and maintain an absolutely uniform speed. It is also very efficient.

In order to make synchronous motors self-starting, a short-circuited winding is sometimes placed



FIGS. 6 AND 7. THREE-PHASE MACHINERY.

in slots in the pole-pieces. Fig. 15 is a diagram of this winding.

Another important type of three-phase machine is the three-phase to continuous-current transformer. It consists of an ordinary railway generator, with collector rings connected to three points in the armature winding. The arrangement is shown in Fig. 16. The machine is now capable of running either as a synchronous three-phase motor or as a railway generator. Now, it is evident that if the field switch at the commutator end is left closed, at the moment the machine comes into phase, a continuous current will be generated at the commutator, and the field will become excited (Fig. 17). The motor will then run synchronously, taking alternating current at the collector rings and developing continuous current at the commutator. Such machines already have wide application in street-railway work.

If the machine builds up with the polarity reversed from that usually employed, it can be reversed by opening the field switch long enough for the armature to drop behind a half of a revolution, and then closing it again.

The following tests were made on four-pole, 100-kilowatt machines, one of which was fitted with three collector rings instead of its commutator, while the other was provided with both commutator and collector rings, the latter being fastened on the shaft where the pulley is usually placed.

The machines were run at much higher speed than is employed with direct-current generators of the same size and style, in order to obtain the proper frequency of alternations. This made it necessary to weaken the fields in order to get the proper voltage, and the iron was not sufficiently saturated. The first tests were made to determine the relations of the strength of field, the load, the voltage at the

commutator, and the voltage at the collector rings. The frames, spools and armature windings of the two machines were exactly alike. The curves, Fig. 18, show the relation between the electromotive force at the brushes of the transformer and the ratio of the field strengths of the transformer and the generator. The voltage at the collector rings was kept constant while making a test.

If both the voltage at the collector rings and that at the commutator are to be kept constant, the strength of the transformer field must be increased, as shown in Fig. 19.

The effect of shifting the brushes is represented in Fig. 20. It is very important that the brushes be properly set, or sparking will occur, but, once set, a wide variation in load is practicable.

The induction motor can be operated at any number of alternations per second which may be required, but the practice is usually to employ a somewhat lower frequency than that hitherto used in alternating-current electric lighting, on account of advantages to be gained in the motors. A lower periodicity necessitates changes in the construction of transformers, in order to secure the same economy. A lower periodicity means that more material must be used, just as a slower speed on a dynamo means a greater weight in order to obtain the same output.

When the periodicity is reduced considerably it becomes very difficult to operate arc lamps on an alternating circuit, and if it is still more reduced the pulsations in current can be noticed in an incandescent lamp.

In addition to the advantages gained in the use of induction motors, the three-phase system has also the advantage of a saving in the amount of copper re-

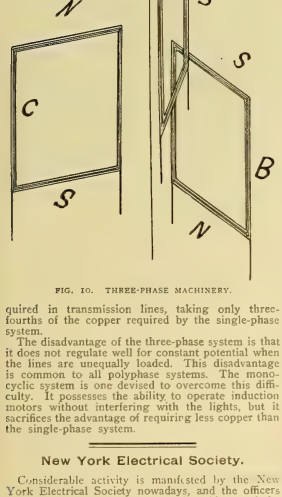


FIG. 10. THREE-PHASE MACHINERY.

quired in transmission lines, taking only three-fourths of the copper required by the single-phase system.

The disadvantage of the three-phase system is that it does not regulate well for constant potential when the lines are unequally loaded. This disadvantage is common to all polyphase systems. The monocyclic system is one devised to overcome this difficulty. It possesses the ability to operate induction motors without interfering with the lights, but it sacrifices the advantage of requiring less copper than the single-phase system.

New York Electrical Society.

Considerable activity is manifested by the New York Electrical Society nowadays, and the officers are to be congratulated upon this evidence of the success attending their management. An indication of the appreciation that is felt for these efforts is the remarkable increase in membership of late. At the meeting on March 30th, for instance, the following-named gentlemen were admitted to membership:

W. C. Broadhurst.	Jens Skougaard.
H. M. Lamont.	E. V. Porter.
G. Morris Haskell.	C. D. Warner.
Edwin H. Daly.	S. Glover Way.
Gustavo Lobo.	Harold Briesen.
Richard Lamb.	Christopher M. Lowther
J. H. Tatavall.	W. J. Clarke.
Fred Cailin.	R. E. Gallagher.
Clarence W. Phillips.	E. S. Stevenson.
Marcus Nathan.	Theodore B. Entz.
Harris I. Goldstein.	W. H. Palmer.
A. L. Saraya.	William P. Crawford.
Joseph Miller.	C. N. Wheeler.
Henry C. Mortimer, Jr	C. W. MacMullen.
Earle Ovington.	C. M. Clark.
Dr. C. A. Doremus.	Joseph C. Vosenes.
George F. Porter.	Calvin Winsor Rice
A. L. Doremus.	J. B. Pearson.
Morton Webster Haddock.	Fenton S. Grant.
Richard Koch.	Philip Mengé.
H. A. Strauss.	D. L. Collins.
F. M. Hawkins.	Louis N. Levy.
Conrad Watchter.	Samuel F. Butterworth.
Elmer P. Morris.	J. J. Bellman
John Maguire.	George Sanders Weston, 2d
John Joyce.	

Biography of a Piece of Copper Wire.[1]

By CHANNING T. GAGE.

I desire to give you as briefly as possible an outline of the various processes through which the bare and insulated copper wire of commerce passes, from its crude natural condition to some of the numerous forms in which it becomes useful to man.

Copper occurs in this country in two distinct conditions. In Montana and Arizona there are enormous deposits of copper ore in the form of sulphides, oxides or carbonates, though it is believed that the two latter are a result of the decomposition of the former.

This ore seems to have been projected upward

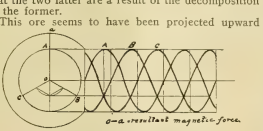


FIG. 11. THREE-PHASE MACHINERY.

in a semi-fluid state from the interior of the earth, and through great fissures or cracks in the earth's crust, after violent volcanic action, which had tilted the rocks from a horizontal to an angular or nearly perpendicular position. These ores require a very complex system of treatment to eliminate impurities and reduce them to metallic copper.

The second class of copper ores is found on the south shore of Lake Superior and constitutes the only natural deposit of ore in the world containing pure metallic copper free from all chemical impurities. There we find it in all forms and sizes, from particles as fine as flour to masses weighing hundreds of tons; from the Phœnix mine there was taken out a single mass weighing 500 tons.

The Arizona ore is the richest of any produced in this country, containing about 10 per cent. of copper; that in Montana contains about seven per cent., while the conglomerate rock of Lake Superior contains from one to four per cent., and the amygdaloid rock from one-half to one per cent. The greater expense involved in reducing and purifying the western ores practically balances their greater richness, so that the Lake Superior mines are able to produce the purest and cheapest copper in the world.

The Lake Superior copper deposits exist in the greatest abundance on that geological freak, Keweenaw Point, jutting out into the waters of the lake for about 60 miles in a northeasterly direction from the upper peninsula of Michigan. Here we find extending nearly the entire length of the peninsula outcroppings of copper-bearing rock, and the same strata have been traced far to the southwest through Michigan and Wisconsin.

Copper ore occurs in two distinct forms in parallel veins on Keweenaw Point.

First—The so-called "ash-beds," or amygdaloidal ore. In this the containing rock is of a soft, easily crushed material, of igneous origin, somewhat similar to lava, and in the porous cells of which the metallic copper is deposited in fine particles. This ore is easily worked, and, as in the Atlantic mine, can be made to pay well, even when containing but three-quarters of one per cent. of metallic copper.

Second—The conglomerate beds, in which the great fissures in the original rocks were filled with a sort of pudding stone, in which the cementing material has been partially displaced by metallic copper, tough and fibrous, binding together the pebbles and stones in masses almost impossible to crush.

Geologists differ somewhat as to the exact process by which this metallic copper was deposited, but many think that these fissures were originally filled with lava in the one case, or the conglomerate mixture in the other, by the action of intense heat and pressure from below. This cooled and subsequently, through a period of time possibly extending through ages, a solution of some copper salt gradually percolated through the fissures, and by a sort of electro-chemical action deposited metallic copper in place of the original cementing material. Thus we find in these conglomerate veins copper in every conceivable form—in little nuggets, thin leaves and threads, and great, irregular, jagged masses.

For the purpose of this paper I will consider that our piece of copper wire originally formed a part of one of these masses and was taken from the famous Calumet and Hecla mine.

There is positive evidence that these copper deposits were once worked by aboriginal miners long before the period of the present race of American Indians.

It is stated that on the site of the Calumet and Hecla mine an Irishman had located his cabin, and one day his pig, in exploring for edible roots, accidentally tumbled into one of these ancient excavations. On getting the pig out it was found to be well covered with a green mud, giving evidence of the presence of copper ore. The mud and rubbish were cleared away and a fine deposit of rich conglomerate rock was uncovered.

These deposits occur in so-called chimneys or strata of copper-bearing rock, alternating with strata of non-metallic rock. In this mine the chimney is about 13 feet in thickness and extends a distance of nearly three miles, of equal richness, and all controlled by this company. They had, in 1891, 17 shafts following the dip of the vein at an angle of about 37 degrees, to a depth of 3,800 feet. Some of these shafts are now down over a mile.

Their latest shaft, recently completed and called the Whiting mine, has three compartments, two for hoisting rock and one for pipes, wires, etc. This shaft extends down vertically 5,500 feet, thus tapping the vein of ore at a point nearly 7,000 feet from the surface of the ground, measured on the dip of the vein. Through this vertical shaft, steel hoisting ropes, 2¼ inches in diameter, lift to the surface 20,000 pounds of ore at a time. At this great depth the ore shows no sign of failing in quality or quantity, and to secure it becomes only a question of expense in hoisting it to the surface.

After the ore has been removed from the mine, and, to a certain extent, sorted, it is sent to the stampmills, where immense stamps crush it to small particles and large quantities of running water wash away most of the pulverized rock, the heavier copper settling to the bottom. This residue contains from 40 to 80 per cent. of copper and is next sent to the smelter. There it is placed in a large reverberatory furnace in 10-ton charges. By treatment with the proper flux and the intense heat of the

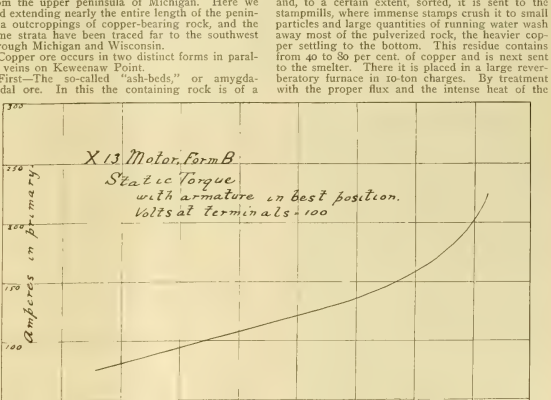


FIG. 12. THREE-PHASE MACHINERY.

furnace, the last vestige of rock and sand is removed and the pure metallic copper is cast into ingots weighing from 250 to 300 pounds each. These ingots are then shipped to the numerous wire mills and enter on the final process of conversion into wire.

At the wire mills the ingots are pushed into one end of a furnace and are gradually brought to a white heat by the time they reach the other end. There a workman reaches in with a pair of immense swinging tongs and starts one of these ingots down the incline and through the first pair of rolls, by which it is somewhat reduced in size and in

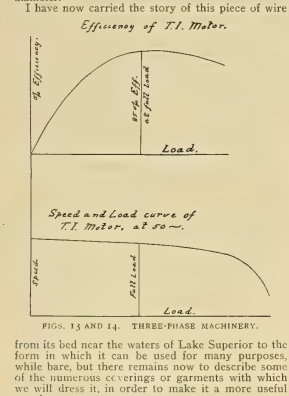
[1] Read before the Chicago Electrical Association, March 15, 1898.

creased in length. Other pairs of rolls are in line just ahead, and the hot ingot passes rapidly through these, until it is reduced to the appearance of a long, fiery snake, writhing and coiling about the great iron floors yet guided through the proper openings by hands that are quick and sure. After passing the last roll, it finally shoots at lightning speed into a revolving reel, into which it is coiled, then removed and hung up to cool. It is now a "rod," about three-eighths inch in diameter and the coil is known in the mill as a "bundle of rods." It is covered with a coating of black copper oxide, and in this condition looks like iron wire, and must be cleaned. It is dipped in an acid bath, where the oxide is dissolved, and the bundle comes out, clean, bright, reddish-yellow copper. This is thoroughly washed and goes to the drawing room. Here one end is tapered and passed through a "die" or block of steel with a tapering hole in it; the end is fastened to a revolving drum and the wire drawn through the die and reeled on the drum. This operation is repeated, each time reducing the size and lengthening the wire, until the desired size is reached. This also thoroughly hardens the wire and makes what we call hard-drawn copper, such as trolley and telephone wire.

For further drawing, or to make soft-drawn copper, the coils are annealed or subjected to a high temperature for a certain length of time, and after cooling the copper is again soft and pliable. This drawing process may be continued until our original ingot, about three feet long, has been lengthened to a piece of No. 36 telephone magnet wire 750 miles in length.

These finer sizes are drawn by specially arranged machinery through dies made from the hardest of precious stones. It is possible by this means to produce an almost invisible wire .001 of an inch in diameter.

I have now carried the story of this piece of wire



FIGS. 13 AND 14. THREE-PHASE MACHINERY.

from its bed near the waters of Lake Superior to the form in which it can be used for many purposes, while bare, but there remains now to describe some of the numerous coverings or garments with which we will dress it, in order to make it a more useful member to society.

First, we will take the simple magnet wire—just a little round wire with a half dozen parallel threads of cotton wound about it.

Remember the great cotton plantations in the South, with the negroes cultivating and picking it; the cotton bolls go to the gin, where the seeds are separated; then go to the baling press, and then to the mammoth mills of New England, where the white threads are spun out by automatic machinery.

In the wire mill this thread is wound on special spools and these are in turn swung around and around our piece of copper wire, held firmly in place, until a beautifully smooth, white covering just hides the wire from sight. One layer of cotton makes our single cotton-covered magnet wire, and a second set of spools following the first winds another set of threads in the opposite direction, and we have double cotton covered magnet wire.

Now bring from China the choicest product of her silkworms, spun into threads of finest quality, and, putting this through the same process, we have silk covered magnet wire, which you all know is such an important factor in telephone construction.

Think for a moment, also, of what might be the present development (or lack of it) of all the varieties of electrical machinery without magnet wire—generators, motors, transformers, voltmeters, ammeters, wattmeters, telephone and telegraph instruments, electric bell and alarms, arc lamps, etc.

When Prof Morse made his first experiments in telegraphy he secured a great length of wire in his laboratory by carrying it around the room back and forth on pegs, and his crude magnet was made by coating a piece of horseshoe-shaped iron with varnish and winding this with bare copper wire, the turns spaced just far enough apart to prevent touching. In the next electro-magnets made by his partner, Alfred Vail, they used the only covered wire then known, viz., that used by milliners for stiffening hats and bonnet rims.

Now, step over into the oil fields of Pennsylvania and see the great tanks full of black, fragrant crude oil; follow it to the refinery and watch the process of distillation and cleansing, until, as one product, you see a clear, white, semi-transparent substance called paraffine, nearly impervious to water, yet easily melted. Wind two layers of heavy cotton over a small wire, at the same time saturating it thoroughly with this warm paraffine, and you have the common annunciator wire, with the aid of which half the doorbells in the city are made to jingle at the push of a button.

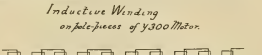


Fig. 15.

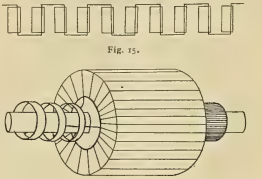


Fig. 16.

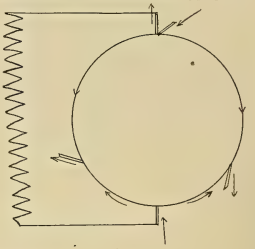


Fig. 17.

THREE-PHASE MACHINERY.

Office wire is made of the same materials, but the cotton is braided on instead of being wound and is made heavier.

Next we will journey to distant Poland and bring back some of that peculiar bituminous deposit called mineral wax or ozokerite, and, combining it with other suitable materials, we will thoroughly saturate the two or three cotton braids which we have woven on another piece of wire, and we will have the well-known weatherproof wire, of which immense quantities are now used for the outside lines of electric-light and street-railway plants. It is also superseding annunciator wire for interior bell and signal work.

Now travel with me once more to still another foreign land, and deep in the forests of South America we will find the wonderful india-rubber tree. Watch a swarthy native as he slashes into the bark with his knife, and there slowly oozes out a milky white fluid, which he deftly catches in a rude basin. This is allowed to stand until upon its surface rises a creamy layer, which he gathers on a clay ball attached to the end of a stick and dries over a fire of leaves and twigs. This rough ball gradually

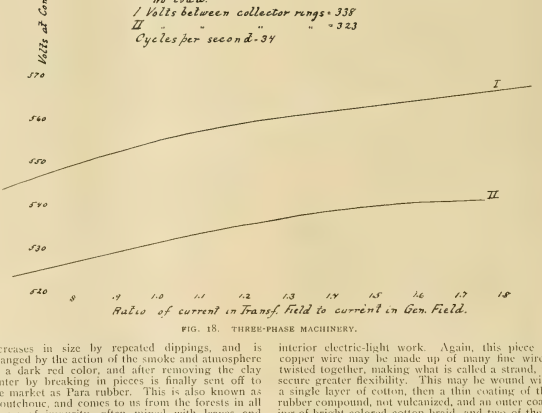


FIG. 18. THREE-PHASE MACHINERY.

thin disks and dried in the air, which changes it to a dark brown color by oxidation.

This brings us to the subject of rubber-covered wire, a product which has during the last few years assisted greatly in the progress of electrical development. When we stop to think of it, is it not one of the wonderful things to consider in nature that this one material possesses the peculiar properties necessary for electrical uses, viz., a perfect insulator, thoroughly flexible, yet capable of receiving treatment that will harden it almost to the texture of ivory and still retain its wonderful insulating properties!

The pure rubber would be almost valueless for many purposes, except for this property of being hardened or vulcanized by the action of sulphur and heat.

That was a wonderful discovery of Mr. Goodyear, which, though called accidental, must have been a part of the Creator's plan for the development of our modern civilization.

Now comes in play the art of the maker of rubber-insulated wire. Pure rubber used as an insulator gradually deteriorates and loses its insulating qualities; therefore he skillfully mingles with it various materials in just the right proportion, and the mixture is then applied to the wire (which has previously been well tinned), with the aid of specially designed machinery, and is then taken to the vulcanizing ovens, where just the necessary degree of heat is applied, and the resulting product is an insulating covering for the wire which will maintain its value as an insulator for many years without change.

Now, taking this plain rubber-covered wire as a basis, look for a moment at its various uses. Covered with a cotton braid, usually saturated with a protective compound, we have the ordinary wire for interior electric-light work. Again, this piece of copper wire may be made up of many fine wires, twisted together, making what is called a strand, to secure greater flexibility. This may be wound with a single layer of cotton, then a thin coating of the rubber compound, not vulcanized, and an outer coating of bright-colored cotton braid, and two of these twisted together form the ordinary commercial lamp cord. This is now being superseded very largely by a similar product made with vulcanized rubber.

We will now take another length of the plain rubber-insulated wire, wind about it spirally a coating of adhesive tape, and pass it slowly through the lead press. By this machine a smooth uniform coating of lead is placed over the tape, making the well-

know lead-encased cables, used so largely for underground service. Pure lead is too soft to withstand the friction of drawing the cable into ducts, so two or three per cent. of tin is added to the lead, which hardens it somewhat, but not enough to permit cracking when bent. This lead covering acts as a mechanical protection to the rubber and adds very materially to its life.

Another class of cables are made, in which the rubber is replaced by a saturated paper insulation. These cables have a very high insulation resistance as long as the lead covering remains intact, but as soon as the lead becomes perforated from any cause, mechanical, chemical or electrical, they must be replaced. For underground telephone lines the paper-insulated cables have a special value, and are extensively used in all the large cities. Usually 50, 75 of 100 pairs of wires are bunched together and a lead casing is placed over all.

For submarine cables, crossing rivers, harbors, etc., the lead-encased rubber cable is covered with a layer of jute and then an armor of galvanized iron wires is laid on spirally for protection against boats and anchors.

For ocean cables there is used as an insulator a gummy material gnown as gutta-percha. It is gathered from tropical trees, similar to caoutchoue, but it has certain properties from an electrical standpoint making it peculiarly adapted for use in submarine work. These cables are not lead encased, but usually have three layers of armoring laid on in reverse directions and well juted between.

The first submarine cable ever laid was in Calcutta in 1839, across the Hugli River; the copper wire was insulated with cotton thread with pitch and tar, and did very good service for a long time.

From that small beginning submarine cables have increased in numbers, until they form a veritable network, encircling the earth in all directions.

Patents and Trademarks.

[From the Washington correspondent of the Western Electrician.]

More important measures for altering the patent laws and the laws governing the registration of trademarks are pending in the present Congress than have been considered in any other within the last quarter of a century. Among the more recent measures is one introduced in the House by Representative Maxwell to amend the Revised Statutes relating to patents. It is now under consideration in the House committee on patents. The bill provides that section 4884 be amended so that every patent shall contain a short title or description of the invention or discovery, correctly indicating its nature and design, and a grant to the patentee, his heirs or assigns, for the term of 17 years, of the exclusive right to make, use and vend the invention or discovery throughout the United States, referring to the specifications for the particulars thereof. A copy of the specifications and drawings shall be annexed to the patent and be a part thereof. The provision is made that no patent shall be granted in any case where the alleged invention is a mere rearrangement or variance in constructive devices and details of an invention already known. It is further provided that where a combination of such details and devices produces a new and useful result, not caused by the separate action of either or all of the old devices and details, but due to the cooperation or reciprocal action of the combined devices and details, it may, if of sufficient utility, be subject to a patent.

It is proposed to amend section 4886 of the Revised Statutes, as amended by the act of March 3, 1897, so that any person who has invented or discovered any new and useful art, machine, manufacture, or composition, or any new and useful improvement thereof not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof, and not in public use or on sale for more than six months prior to his application, may secure a patent, if the device be of sufficient utility, unless it is proved to have been abandoned by a failure to make application in six months, in which case no patent shall issue.

The third section of the bill is to amend section 4919, and provides that damages for the infringement of any valid patent may be recovered in a civil action by anyone interested as patentee, assignee or grantee, but before an action can be maintained against one who has purchased and used in good faith a machine, instrument, or composition so patented, the patentee or his assignee who claims an infringement must recover a judgment against the party guilty of such alleged infringement, and establish the same. Whenever in such action a verdict is rendered for the plaintiff the court may render judgment thereon for any sum within the amount found by the verdict as actual damages, together with the costs, but not for damages in excess of the verdict.

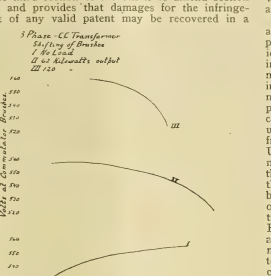


FIG. 20. THREE-PHASE MACHINERY.

A bill has been introduced in the Senate by Senator Platt of Connecticut providing for an increase in the working force of the Patent Office in order to facilitate the work of the office, which is greatly in arrears. The bill provides that for the purpose of determining with more readiness and accuracy the novelty of inventions for which applications for letters-patent are or may be filed in the Patent Office, and to prevent the issuance of letters patent of the United States for inventions which are not new, the commissioner of patents be authorized and directed to revise and perfect the classification by subjects-matter of all letters patent and printed publications in the United States Patent Office which constitute the field of search in the examination as to the novelty of invention for which applications for patents are or may be filed.

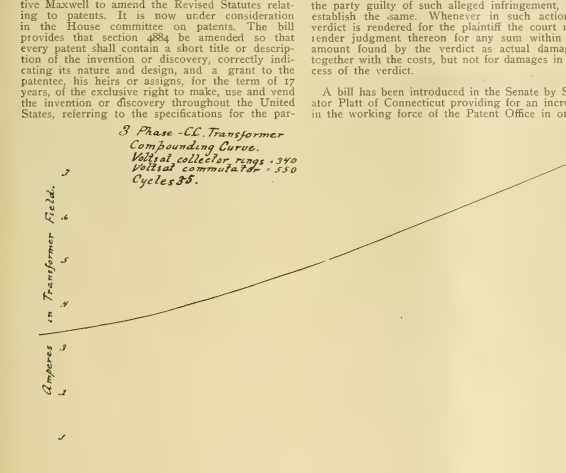


FIG 19. THREE-PHASE MACHINERY.

In connection with the International Union for the Protection of Industrial Property, which was formed in 1883 through the convention concluded at Paris on March 20th of that year, the Union for the International Registration of Trademarks is of importance. This subordinate union was formed at the conference at Madrid in 1890 and concluded by an arrangement signed at Madrid, April 14, 1891. It includes at present nine nations. The purpose of this union is to enable a citizen of one of the members of the union having registered his trademark in his own country to secure registration of that mark in all the other countries of the union without the difficulties and delays attendant upon applying separately for registration in each country.

The importance of having trademarks protected, and in many countries registration is necessary to protection, has been forcibly impressed upon American manufacturers who, on sending their goods into a foreign country, have found the very trademark which has become of value to them registered in that country to some citizen of that country who made application for registration for no other purpose than to enable him to demand of the American manufacturer a price for the right to sell goods under that trademark in that country. This has frequently happened, especially in Germany. A United States manufacturing firm, whose trademark is known from one end of the country to the other, recently complained to the Patent Office that its trademark had been copied and registered by a German manufacturer, who was able, by virtue of his registration, to stop the American manufacturer's trade in Germany. As in a number of European countries registration of a trademark is attributive of property in such mark and is granted not to the first adopter and user of the mark, but to the first applicant for registration, and as in these countries the registrant can under the laws forbid the importation of goods marked with the trademark registered by him, or even compel the seizure of such goods, it is evident that such registrant has the manufacturer who is the rightful owner of the mark completely at his mercy so far as trade in that country is concerned.

It is believed that the international registration of trademarks, which may be effected through the union, would be of material value and is practically indispensable to those of our manufacturers who desire to develop their foreign trade. In the interest of these manufacturers it is urged that the United States should become a member of this union.

At the recent conference of the International Union, which was held at Brussels, the United States delegates, Hon. Bellamy Storer, minister to Belgium, and Mr. Francis Forbes, took an active interest in the discussion of changes proposed in the agreement respecting the international registration of trademarks, though the United States was not a party to that agreement. The purpose of this agreement is to make the international bureau at Berne the center of a cheap registration which shall be efficient over the territory of the adhering states. The fee for this international registration was reduced to 100 francs for the first mark and 50 francs for each of all other marks for registration at the same time by the same owner.

Senator Hanna has introduced the following amendment to the patent laws:

"That in cases of infringements or alleged infringements by purchasers or users of any patented device whatever, any individual, company or corporation, to establish their claims upon patents of said devices, shall, in the courts having jurisdiction, enter suit against said purchaser or user within the space of five years from the date of the first alleged infringement by said purchaser or user, or be forever debarred from collecting royalty or damage for the use of said device, to the end that the purchaser shall become the owner in reality as well as in name, and not be further molested.

"That any individual, company or corporation owning or controlling patents acquired by purchase or otherwise, in case of alleged infringement by any inventor or manufacturer of any device whatever, to establish their claim of infringement on said device shall, in the courts having jurisdiction, enter suit within the space of one year from the date of said infringement, or be forever debarred from collecting damage from said inventor or manufacturer, though this act shall not be so construed as to debar any individual, company or corporation from establishing their ownership to patents upon said device thus manufactured."

The reasons offered for the presentation of this bill are that there exists at present an abuse of the rights and privileges granted to owners of patents which has become widespread and is causing great inconvenience and unnecessary expense to innocent purchasers of devices upon which two or more individuals, companies or corporations claim patent. These claims are said to be made often through the use of telegrams, circulars, pamphlets, letters and advertisements, threatening and intimidating purchasers of such devices, the intimidation sometimes extending over months and years. In a majority of cases it is contended that the cost of defense of the purchasers' rights would be far in excess of the amounts claimed, and in these cases settlements are forced to be made before claims have been thoroughly established. It is therefore contended that such a bill will give ample time to recognize the rights of inventors and yet protect purchasers from great inconvenience and loss, such as is frequently sustained under the present system.

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Diplomatic circles are in a state of excitement over the discovery that there has been considerable tampering with the English government's dispatches, relating to the negotiations over the eastern complications. When events in the far East began to assume a serious aspect, the British Foreign Office made the unpleasant discovery that its dispatches were being tampered with, and it became necessary to discard the old cipher code and devise a special one. It was concluded that the tampering occurred in China and that the wires between Pekin and Shanghai had been tapped. One incident that was particularly exasperating is related. An important dispatch addressed to the British minister at Pekin disappeared on the way, and frantic efforts are now being made to find it. The disappearance was probably accidental, but the Foreign Office is much perturbed. All employes of the Eastern Telegraph company are Englishmen, and their faithfulness is not questioned.

Municipal elections in Chicago and Milwaukee this week and in Des Moines last week indicate that greater restrictions will be placed upon quasi-public corporations hereafter, if the temper of the people was rightly shown on these occasions. The successful candidate for mayor in Des Moines is an avowed champion of municipal ownership, Milwaukee's new mayor was elected on a platform pledging him to the establishment of a municipal-lighting plant and reduction of street-railway fares, and the chief feature of the Chicago contest was the movement for the election to the council of men pledged to the exaction of compensation for the city for all public franchises. The Allen law was made an issue, and those who supported that measure with few exceptions suffered defeat. The result in all these places, particularly Chicago, is fraught with interest to quasi-public corporations. In Milwaukee there were many side issues that tended to heighten the effect, but it is unnecessary to review them here. It is sufficient to know that they combined to promote the election of the men who bitterly assailed the existing corporation, with the result that the interests represented by Henry C. Payne received their first public set-back in six years. No doubt Mayor McVicar's personal popularity and his prominence in the association of mayors helped to ensure his re-election in Des Moines.

Popular Science News prints a communication from Lewis Swift in which the writer takes issue with Dr. Gilbert and all the philosophers and scientists from that time down to the present day in explaining "Why the Magnetic Needle Points North." To begin with, the statement is made that "the earth is no more a magnet than is a piece of wood." It is contended instead that "it possesses the power called gravitational attraction, and so has a piece of wood," but it is insisted that "neither the earth nor wood has any effect upon a suspended magnet."

The explanation advanced is "that there is a constant flow of electricity around the earth parallel to its magnetic equator; and the fact that a suspended magnet will always assume a direction at right angles to such a current is the cause, not the attraction of the earth." The suggestion is offered that while "the source of the electricity is, of course, unknown," it "probably is the sun."

Nothing is said to fix the identity of the writer, but it is probable that Dr. Lewis Swift, an amateur in astronomy, who gained some distinction about 15 years ago by his successful search for comets, is responsible for the communication. Dr. Swift has dabbled in all branches of science and has evidently lost none of his old-time enthusiasm; nor has his appreciation for sensational discoveries diminished.

The New York Sun having commented on "The Doom of Snoqualmie," basing its editorial on a recent illustrated article in the Western Electrician on "Snoqualmie Falls Transmission," the Electrical Review comes to the front with the statement that it presented a "larger and better engraving of Snoqualmie Falls" over three years ago. The Review misses the point of the Sun article as well the purport of that in the Western Electrician. The Sun dwelt on the commercial utilization of a "glorious expression of Nature's visible force;" the Western Electrician supplied the information of work in progress, on which the contrast of Nature's grandeur and man's invention was based. Three years ago the Electrical Review did print a picture of Snoqualmie Falls, but it was in connection with a "Snoqualmie Falls Electric Power company" which never materialized in action and which at the time was trying to sell bonds in New York city. The promoters' scheme failed, and now the Western Electrician has given the news of a new company, with a different and enlarged plan, which has actually begun work on a very interesting plant. Pictures and descriptions of Niagara Falls were printed a hundred years ago, but the first illustrated description of the power plant now in operation there had a very different meaning to engineers. As to the Review's picture, it was but a trifle larger than that in the Western Electrician—though the size is of no importance—and it was certainly no better.

Discussion of methods of charging for telephone service continues to attract attention. It has been suggested in France that a scale of charges be established either upon the number of calls per annum or upon the total time that the subscriber is in circuit during the year. Further modification is advocated, depending upon whether a call is to a subscriber in the same or in a distant district. The working expenses of the company depend upon the number and duration of the calls, and upon the number of distinct offices through which communication has to be established for a particular call. It is explained that if the subscribers are on different exchanges the switching operations occupy time and require an increased staff. The method of charging by annual tax, supplemented by the number and duration of calls, has many advocates, but the dual system of tariff leads to complication, and choice has to be made between a tax founded upon the number of calls and one proportional to the time consumed. Preference is given to a tariff based upon the number of calls, where any system of this kind is to be employed, but thus far the telephone interests have found a flat rate far more desirable in this country. In some instances where the Bell company attempted to force a tariff schedule upon its subscribers it found considerable difficulty, and in one case particularly, that of Rochester, N. Y., it was ignominiously defeated. Since that time it has lost much of its enthusiasm for the tariff schedule.

Several dramatic incidents were reported in connection with the flood at Shawneetown, Ill., last Sunday, but none possess more interest than the heroic attempts that were made by the telephone company's employes to give the alarm and summon relief. Cypress Junction, which is five miles from the scene of the flood, was the first place to hear the news. The bulletin came by long-distance telephone. It was of dramatic and horrible brevity.

"The levee has broken! The water is rushing in from the bend a mile and a half up the river. Already 250 people are drowned in the lower part of town and——"

At this point the operator sending the message ceased speaking, the wires went down and all efforts to regain connection with Cypress Junction failed. A few particulars were received at Evansville, Ind., some time afterward. Two citizens of Shawneetown who had escaped the flood rowed a skiff to a small town near by and telephoned the brief facts of the catastrophe. They had but few details to give. An appeal for aid was received by the mayor of Evansville later in the evening. The message was transmitted by a telephone lineman, who climbed a pole four miles above Shawneetown and made a temporary connection to call for aid. Other towns in Indiana were also notified and a few details were thus gathered. The manager of the telephone exchange at Shawneetown gave Mount Vernon its first definite news of the big inundation at the little city down the Ohio River. His message contained the following statement: "I am four miles from Shawneetown now. I escaped and made my way here with a portable telephone. I climbed up a telephone post and made a connection, and that is how you are getting the news."

The telephone company's employes proved themselves to be heroes of the occasion. Their energetic and intelligent efforts ensured immediate relief for the sufferers, and demonstrated again in no unmistakable manner the importance to every community of electrical communication with the outside world. Had it not been for the telephone neighboring cities could not have been notified of the dire necessities of the people of Shawneetown and relief expeditions could not have been summoned as speedily as they were in this case.

WAR NEWS.

As this number of the Western Electrician goes to press the issue of peace or war between the United States and Spain hangs trembling in the balance, with the probability that war will ensue. The electrical men are alert and patriotic citizens and will take an honorable part in the conflict, if one shall come. Some of the electrical preparations and proposals for war are noted below.

Telegraphic Preparations.—Of course one of the most important of the electrical war precautions is that relating to telegraphic communication along the coast and to and in the West Indies. The government is working energetically in this direction. A dispatch from Savannah states that it has arranged for the establishment in one day's time of its own telegraphic system for secret service along the entire Atlantic coast. The whole coast will be divided into districts. Savannah will be district No. 4, and headquarters will be established there. The sub-stations in Savannah's district will be Cape Romain, Charleston, Hilton Head, St. Simon's, Mayport, Fla., and Cape Caneve. The government intends to build houses on the beach, where naval reserve officers will be stationed with telescopes to keep watch and report to headquarters in the city all ships sighted at sea. The system will have connection with the Western Union telegraph wires and the long-distance telephone. Three operators will be stationed in the main office in Savannah, which will be in full charge of the office and the signal corps. The Savannah office will be in direct communication with the Navy Department at Washington.

In New York, Boston and other harbors the work of connecting the coast defenses for electrical communication is proceeding with energy. As a result of representations made by Capt. James Allen, signal officer stationed at Governor's Island, to General A. W. Greely, chief signal officer, of the absolute necessity of the expenditure of more than $25,000 in the telephonic and telegraphic connections between the fortifications in New York harbor, New York will get $25,000 more to complete this work according to the original plans. Boston will get about $10,000, Philadelphia about $5,000, and Washington, Baltimore, Newport and Portland, Me., will also get increased appropriations. The total increase for the Department of the East is $96,000. This increased appropriation will make it possible to do an especially important work. All coast fortifications are provided with range finders for the purpose of determining the distance from the fortification of an enemy's vessel. These, if they are to be used effectively, must be supplemented by telegraphic apparatus, to enable the man in the tower to telegraph to the gun pits the range of the approaching vessel. The majority of the range finders in the fortifications are now so equipped. Now every one will be within 30 days.

One serious problem is the possible interruption of cable service in the West Indies in the event of war. A dispatch from Washington on Monday stated that an arrangement was reached during the day by which the United States and France will co-operate through their ministers at Denmark in the establishment of a public cable station on the Danish island of St. Thomas. The cable is owned by a French company, but its use has become of vital importance to the United States government, owing to the possible base of naval operations in the Leeward Islands. Secretary Long was particularly desirous of having this cable arrangement effected. As a result of conferences a dispatch was sent to the United States minister at Copenhagen asking him to secure the consent of the Danish government, and at the same time the French authorities arranged to have their minister at Copenhagen exert similar influences. With the Leeward Islands, of which St. Thomas is a center, as the probable center of any naval operations which may result from the present crisis, it is recognized as of vital importance to secure cable facilities not controlled by Spain. At present the cable line touching at Puerto Rico, and subject to Spanish control, is the only means of communicating with these islands. The French cable lands at St. Thomas, but the station is merely for testing purposes, and messages are not received or delivered. It is now proposed to have this station turned into a regular bureau, in which case the government could be brought into close cable communication with any naval rendezvous there.

Under date of April 5th Mr. Curtis telegraphs from Washington to the Chicago Record this statement: "As if in anticipation of trouble the Spanish government has recently laid new telegraph cables from Santiago, on the south side of the island, to Santo Domingo and to Kingston, Jamaica, which are connected both with the Windward Islands and South America and also with the Bermudas, in order that they may have communication with Spain quite independent of Key West. Until recently all of the dispatches that have passed between Havana and Madrid were sent by way of Florida and New York, and that line continues to be used to a limited extent. In case of war, of course, it would be cut off, but the authorities at Havana would still have three lines to choose from; the first by way of Jamaica and Panama, down the west coast of South America and across the continent to Buenos Ayres, up the east coast as far as Pernambuco, and then across the Atlantic to Lisbon or to Cadiz. The second route would be by way of Haiti and the Windward Islands to Trinidad, Demarara, Para and Pernambuco, and the third by way of Haiti, to Bermuda. One of the first things to be attempted by our government would be to cut all these cables, in order that the authorities at Havana might have no means of communication with the home government."

War News in Chicago by Telephone.—With customary enterprise General Manager Hibbard of the Chicago Telephone company has determined that every one of the 14,000 subscribers of the Chicago exchanges shall be informed if war is declared within 20 minutes after the official declaration is issued. Just as soon as the news is received and verified by the company every operator will begin to ring up subscribers and notify them as quickly as possible. "Our idea in doing this is to inform our patrons of the declaration probably quicker than they would otherwise get the news," said Mr. Hibbard. "We are a quasi-public corporation and we rather consider it our duty to act this way. It is a tremendously important question and everybody is keyed up to a high tension awaiting the final word in the affair. We figure that we can inform our patrons—everyone of them—within 20 minutes after we get the news. Of course we will try to guard against any canard, but in no event will we assume responsibility for the news as we send it out. Our operators will simply tell the subscribers that we have received it as news."

Cable-layers for Emergency Service.—The following statement is published by the New York Sun: "From one of General Merritt's staff officers it was learned that the Western Union and the Postal Telegraph companies have begun to organize corps of skilled electricians, whose services are to be offered to the government should war be declared. The Postal Telegraph company has already organized three companies of 50 men each in New York and an equal number in Boston for this service. The particular work expected of the men is the laying of submarine cables and connecting them with submarine mines and torpedoes. Every man in each company has been provided with a kit of tools, which, under orders, he carries with him day and night. The men have been informed of the service expected of them, and they have been informed that, should war be declared, they would draw their salaries from the company as well as their pay from the government."

X-ray Proposed for Military Surgery.—Lynde Bradley of Milwaukee has devised plans for the use of the X-ray on board of war vessels and on the field. Mr. Bradley says that while it would be a simple matter to bring the X-ray into use on a warship, considerable difficulty would be attached to the introduction of the appartus on the field. A small outfit would have to be mounted on wheels for field use. The apparatus would, however, be much lighter and more portable than may be imagined, and his field apparatus could be finished in a week. The great help that the X-ray would be to surgeons lies in the quick method of locating a bullet or splinter in a man's body, a fracture of a bone or other serious injury.

Searchlights.—The war excitement has created a demand for searchlights for naval and coast-defense use. Of course all the regular ships of the navy are supplied, but projectors are needed for the auxilliary fleet and along the coast. It is said that the government has practically closed a contract with the General Electric company for eight 400,000 (projected) candle power searchlights with dynamos, to be set up in the fortifications in New York harbor. This order will be supplemented in a short time by one for several more to be placed elsewhere. According to the present plan four will be set up near the observation tower at Coney Island, and one more will probably be set up at Fort Hancock. The greatest delay that will be experienced in furnishing the searchlights on short notice will be due to the reflectors, which cannot be ground and tested without the lapse of some time. However, it is stated that there are available for purchase about 400 mirrors in France, England and Germany, and none elsewhere, and that 20 of the best of these mirrors have already been bought.

The largest searchlight that had a place on the top of the manufactures building at the World's Fair has been brought from Sandy Hook to Fort Monroe, Va. It will illuminate Hampton Roads from shore line to shore line.

Electrical Firing of Mines.—Electrical circuits play a necessary part in the explosion of submarine mines in harbors. The following story, sent by the Associated Press from London on April 4th, is of especial interest to electrical men:

Details have been obtained by the Associated Press of the manufacture of submarine mines in London for Spain, which was first brought to the attention of the United States embassy and cabled to the Associated Press on March 5th. A man whose cards described him as being an electrical engineer and whose name was forwarded at the time to Washington, then said he sold to Spanish officers in London several years ago a large number of mines, eight or ten of which were placed in Havana harbor. He said they were made in a special way, had a specially constructed cable, which he can identify if the smallest piece is produced, and he added that some of the mines were fixed so that they could be fired from a fort, while two of them had bulbs so arranged that they would explode upon a vessel coming into contact with them. The man added, however, that he did not believe the bulbs would be used in water as shallow as that of Havana harbor. Finally, the man exhibited plans of one of these mines, which he said was most likely to produce the effect described as causing the wreck of the Maine. It was numbered "2" and was constructed to contain 500 pounds of gun cotton.

Lieutenant Commander J. C. Colwell, the United States naval attache, has since investigated the matter, and has made a report on the subject to the United States government. The facts learned strongly tend to show that Havana harbor was mined, and they unquestionably prove that Spain purchased mines for that purpose. The firm of Lattimer, Rhodes & Clark, electrical engineers, during 1887-88, filled a large order for Spain of a lot of mines, in which were used 14½ tons of gun cotton. The work was directly under the surveillance of General Fernandez and Captain Bustamento. The latter was then the head of the Spanish torpedo school. By order of these officers the mines were divided into four consignments—for Havana, Ferrol, Cadiz and Carthagena. The mines were manufactured under the direction of J. P. Gibbons after Gibbons' patents.

Gibbons, from whom a representative of the Associated Press obtains the information, and who furnished to Lieutenant Commander Colwell a written statement of the above facts, and outlined his theory of the explosion which wrecked the Maine, was then employed by the firm as superintendent of the topedo department. He also says a similar lot of torpedoes was manufactured for Spain in 1896.

The manager of the Westminster Engineering company, which is the successor of the aforementioned firm and with which Gibbons is connected, confirms the latter's statement as to the manufacture of mines for Spain. Gibbons, who is a former sergeant of engineers and a government inspector of torpedoes, believes the Maine's first explosion was caused by what is technically called a ground mine, containing 500 pounds of gun cotton, several of which were manufactured for Spain.

He has experimented with these mines largely at Portsmouth and says that once laid they retain their properties for 50 years. In addition, Gibbons asserts that it is absolutely impossible for them to explode accidentally, as the electric currents for their explosion are formed only by the manipulation of a complicated keyboard, especially devised to prevent accidents. Three keys are necessary, which are always kept in the possession of different officers, and, even if an outsider obtained possession of them, it would be impossible to manipulate the keyboard without instructions.

Gibbons further says the mines and their connecting cables are numbered, and he asserts he would be able to identify them if any part is secured.

Miscellaneous Notes.—The General Electric company, which is constructing the electrical apparatus for the battleships Kentucky and Kearsarge, is pushing the work with all possible speed. These ships will be the first to be equipped with electrical moving turrets and hoisting machines.

Frank C. Mason, superintendent of the city telegraph bureau in Brooklyn, has written to General Merritt offering his services to the government in case of war. He is an expert Morse operator.

It is stated that such has been the government's demand for insulated wires and cables in New York that the visible supply has been nearly exhausted.

Contracts for Chicago Street-lighting Plants.

Under the appropriation for electric street-lighting extension recently made available by the City Council of Chicago, contracts were awarded last week for much of the apparatus needed. An order was placed with the Western Electric company for 10 arc dynamos having each a capacity of supplying 150 lamps of 2,000 nominal candle power. The lump price for the 10 machines was $20,500. The engine contract was awarded to the Charles F. Elmes Engineering company of Chicago, which will supply two vertical cross-compound condensing engines of 600 horse power each, complete on foundations, for $12,075. This contract, as all others, was awarded to the lowest bidder, and it is also stated that the Elmes company made the best guaranty of water consumption and the best guaranty for the cost of repairs for five years. The American Electrical Works of Providence secured the wire order —100 miles of No. 6 weatherproof wire—at $70.12 a mile, while the lamps are to be supplied by Charles E. Gregory for $10 each. The lamps are to be 14-hour, single-carbon mechanisms, with single side-arm frames, and 1,100 are to be furnished. Smaller equipment will be supplied by the Central Electric and Western Electric companies.

The new lights are to be placed in the northwestern section of the city and on the West Side and South Side. One plant will be placed in the station at Rice and Lincoln streets which was built for a city arc-light plant, but afterward used for other purposes. In numerous instances the Chicago City Railway company has allowed the use of its poles on the South Side to carry the city's lighting circuits for this new service. Permission for similar favors has been refused by the North and West Side Street Railway companies. Mayor Harrison takes great interest in the plans for better street lighting, and he accompanied City Electrician Ellicott last week in several drives about the city to locate plants and areas to be supplied from them. He contracted a severe cold in doing so, but says he is going at it again until satisfied that the new lamps are located to the best possible advantage.

Pacific Cable Project.

Late advices from Honolulu announce that the Hawaiian Legislature is considering a bill authorizing the construction by the Pacific Cable company of a cable between the United States and the islands.

The Hawaiian bill gives the company exclusive cable rights for 20 years. The cable must be laid within 18 months after the passage of the act by the American Congress and extended to Japan within three years. It must be capable of transmitting 15 words a minute, and the toll rate between Honolulu and San Francisco is not to exceed 35 cents a word, and to Japan it is not to exceed [illegible] cents a word.

DEVELOPMENT OF THE TELEPHONE FIELD.

American Bell Telephone Company's Annual Report.

[Special Correspondence of the Western Electrician.]

Boston, March 29.—The half hundred persons who were present at the annual meeting of the stockholders of the American Bell Telephone company held in Chipman Hall, Tremont Temple, to-day, heard reports which must have satisfied them that the year 1897 had been a phenomenally successful one for the company. President John E. Hudson occupied the chair and Charles E. Hubbard officiated as clerk. The latter was re-elected clerk of the corporation and William R. Driver was also re-elected treasurer without a dissenting vote. Balloting for directors resulted in the election of the following-named gentlemen: Charles W. Amory, Thomas B. Bailey, Francis Blake, George L. Bradley, Alexander Cochrane, T. Jefferson Coolidge, Jr., J. Malcome Forbes, Henry S. Howe, Charles Eustis Hubbard, John E. Hudson, Charles E. Perkins, Thomas Sanders and Moses Williams. Thomas B. Bailey and J. Malcome Forbes are the new members of the board, succeeding W. H. Forbes and Gardiner G. Hubbard, deceased. President Hudson's annual report was in substance as follows:

"We omit, in this report, the list of cities and towns in which the underground system of wires has been adopted, with the comparative figures of mileage in successive years, which has formed part of several preceding reports. This system has now come into general use for the placing of conductors for exchange use in the closely built sections of the larger cities. While it has been found that lines carried in this way are exposed to disturbing causes, peculiar to this class of work, they secure immunity from the effects of destructive storms, and, on the whole, this may be regarded as the most durable kind of construction. The limitations of the use of underground lines as regards distances are quite obvious. So far, therefore, as the development of the art has gone, it is still impracticable to employ underground lines for what is known as toll or long-distance service. The underground system is now in use in 130 of the exchanges, and 282,634 miles of exchange wire, that is, nearly 50 per cent. of the total mileage in the United States is now carried by means of the underground conduits.

"The output of telephones and the increase of the number of exchange subscribers reported by the companies operating under our licenses are unprecedented in the history of our business. In fact, the gain of exchange stations recorded for the last two years equals the aggregate for the six years which preceded. Almost the entire increase for the last year is made up of stations connected by metallic circuits. Part of this growth may be attributed to the general enlargement of population and business throughout the country, the greater efficiency of the service, and the growing recognition of the telephone as a valuable agent for the transaction of business and the convenience of home life. In part, also, it is due to the efforts of the operating companies to bring the service within the reach of the numerous class of those who have need for a limited use of the system, and have not felt justified in incurring the expense for an exclusive circuit and unlimited exchange service. Improvements in the method of equipment have removed the difficulties which formerly attended the operation of party lines, and have made it possible, without confusion or material delay, to furnish service to two, three or more subscribers on the same circuit, who do not require a great number of connections. The system of measured service continues to grow in public approval. The subscriber pays for the specific number of outgoing exchange connections for which he contracts, or as many more as his needs require, and is at no expense for inward calls.

"During the year the long-distance lines have been extended to reach Omaha in the west, Minneapolis to the north, and southerly to Petersburg and Norfolk. There were in operation on the 1st of January, 1898, 8,778 miles of pole-line and cable and 116,116 miles of wire connecting 238 offices, an increase during the year of 1,433 miles of pole-line and cable, 8,706 of wire and 55 offices. In all there are 35 companies reached whose systems furnish our long line terminals. These companies report a total of 325,250 stations, of which 146,394 (45.01 per cent.) are equipped with metallic circuits, and of these 146,394 stations 22,028 are equipped with long distance cabinet sets. The new construction completed by companies with which we have contract relations amounted to $8,712,914. Of this sum $4,865,317 was expended upon exchange construction and equipment and $3,847,596 upon toll lines. In addition to the above, $1,484,331 was invested in real estate, to be used for company and exchange purposes. The entire expenditure for construction, including real estate to the close of 1897, has been $97,946,102.

"The long distance company had invested up to December 31, 1897, in construction, franchises, equipment and supplies, $13,888,751. The company shows an increase in gross earnings in 1897 over 1896 of 16.1 per cent., the amount for 1897, gross, being $1,870,203."

Operations of the company for the year ended December 31st compare as follows:

	1897.	1896.	Increase.
Gross	$5,130,844	4,327,324	803,520
Expenses	961,170	943,743	17,427
Net	4,169,674	3,383,580	786,094
Regular dividends	2,939,904	2,683,983	255,921
Extra dividends	743,044	677,250	65,794
Reserve for depreciation of insts.	47,216	22,347	28,869
Total Surplus	2,590,521	2,151,011	439,510

The balance sheet as of December 31st compares as follows:

DEBTORS.	1897.	1896.	1895
Telephones	$ 1,772,596	1,537,761	1,285,946
Real estate	1,052,695	1,046,126	1,045,926
Stocks and bonds	52,857,205	50,511,149	44,121,680
Merchandise and machinery	18,319	17,484	14,054
Bills and accounts receivable	3,275,059	1,490,930	3,463,213
Cash and deposits	1,833,964	900,271	1,337,892
Totals	$60,779,841	$55,503,723	$51,268,715
CREDITORS.			
Capital stock	$25,886,300	23,650,000	21,500,000
Premium account	6,110,582	3,561,200	1,398,435
Debentures	2,000,000	2,000,000	2,000,000
Bills and accounts payab'e	1,216,330	1,204,591	1,126,616
Patent account	12,399,047	12,397,621	12,713,309
Profit and loss	6,551,431	6,551,403	6,349,444
Reserve	4,025,628	3,987,896	4,035,399
Surplus	2,590,521	2,151,011	2,151,011
Totals	$60,779,841	$55,503,723	$51,268,715

The following comparative statistics are of interest:

	1897.	1896.	1895.
Telephones December 20	919,121	772,627	674,976
Exchanges January 1	1,025	967	927
Branch offices	937	832	686
Miles wire on poles	327,315	286,644	260,324
Miles wire on buildings	13,776	12,597	12,861
Miles wire underground	282,634	234,010	184,515
Miles wire marine	2,675	2,818	2,028
Total miles wire	626,400	536,859	459,728
No. of circuits	295,904	264,465	237,837
No. of employes	16,682	14,425	11,930
No. of stations	384,230	325,726	281,695
No. daily conversations	3,099,472	2,630,071	2,351,420

The report of the treasurer, William R. Driver, is as follows:

LEDGER BALANCES, DECEMBER 31, 1897.

DEBTORS.		
Telephones	$ 1,772,596.55	
Real estate	1,052,695 92	
Stocks and bonds	52,827,205.59	
Merchandise and machinery	18,319.68	
Bills and accounts receivable	3,275,059.70	
Cash and deposits	1,833,964.11	
CREDITORS.		
Capital stock		$25,886,300.00
" " premium account		6,110,582.00
Debenture bonds, 1888		2,000,000.00
Bills and accounts payable*		1,216,330.89
Patent account (profit and loss)		12,399,047.16
Profit and loss		6,551,431.94
Reserve		4,025,628.29
Surplus		2,590,521.27
	$60,779,841.55	$60,779,841.55

*Of this amount $1,164,883.50 is for the dividends payable January 15, 1898, to stockholders of record December 31, 1897.

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

EARNINGS.	1896.		1897.
Rental of instruments	$1,238,378.03		$1,597,959.36
Dividends	2,616,307.00		3,085,379.00
Com. from ex.-terr. lines	182,265.32		211,507.21
Com. from teleg. business	34,046.88		33,174.32
Real estate	80,864.38		84,709.85
Interest	171,355.23		117,071.93
Miscellaneous	4,107.41		1,043.25
	$4,327,324.25		$5,130,844.92
EXPENSES.			
Expenses of operation	$ 499,052.31		$ 509,314.02
Legal expenses	100,744.78		136,333.49
Real estate	40,117.87		41,560.76
Interest and taxes	303,731.38		273,961.92
Miscellaneous	97.47		
	$ 943,743.81		$ 961,170.19
Net earnings	$3,383,580.44		$4,169,674.73
Surplus acc't., Dec. 31, 1896		$2,151,011.61	
Net earnings, 1897		4,169,674.73	
			$6,320,686.34
Regular dividends, 1897		$2,939,904.00	
Extra dividends, 1897		743,044.50	
Reserve for depreciation of insts.		47,216.57	
			3,730,165.07
Surplus acc't., Dec. 31, 1897			$2,590,521.27

Farmers' Mutual Telephone System.

One of the largest farmers' telephone associations ever organized has been formed at Osco, Ill. It is a mutual association and consists of the representative farmers in Henry County. The system will practically connect all the farmers of the entire county with the towns of Osco, Cambridge, Andover, Orion, Morristown and Genesco.

The association contemplates putting in the very best construction and has adopted the Stromberg-Carlson apparatus throughout.

Bell Interests in New England.

[Special correspondence of the Western Electrician.]

Boston, March 30.—The New England Telephone and Telegraph company filed its certificate of condition, under the law, with the secretary of state at the state-house to-day. It is as follows: Fixed capital, $12,000,000; capital paid in, $11,414,300; assets, real estate, $25,219; cash and debts receivable, $1,423,574; manufactures, merchandise, material and stock, $333,511; patent rights, $14,620,934; miscellaneous, $30,000; liabilities, capital stock, $11,414,300; debts, $3,484,582; reserves, $501,438; reserve for depreciation, $1,032,919.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Iowa Telephone company at Davenport, Ia., is troubled by stray currents entering the telephone cables and damaging the service. It has thus far been impossible to trace the trouble, but it is supposed to come from the return wire of the street-railway system. This is believed to be unequal to carrying the current put upon it, and some of it gets into the telephone conduits.

The Minnesota Central Telephone company will build a line from Glenwood, Lowry and Sedan, Minn., to connect with the long-distance wire to Minneapolis.

A telephone system will be established in Lewistown, Mont., as soon as the frost is out of the ground.

The Iowa Telephone company is arranging to connect with Littleton and Jessup, Ia.

E. M. Hungerford of Billings, Mont., has been granted a franchise for an exchange in Miles City, Mont.

Jones & Winter of St. Paul have the contract to install the telephone system for Litchfield, Minn. Between 80 and 90 instruments have been subscribed for.

The Des Moines Southwestern Telephone company has been incorporated at Clearfield, Ia., with $20,000 capital stock.

George Pfeferkorn will establish a telephone exchange in St. Charles, Minn., at once.

The Northwestern Telephone Exchange company has absorbed the independent exchange at Jamestown, N. D., and will rebuild it. The company will also extend its wires from Valley City to Jamestown.

The Union Telephone company of Richland Center, Wis., proposes to extend its wires to Dubuque, Iowa.

E. B. Rowlee, of the Rushford Telephone company of Rushford, Minn., proposes to connect Stephen, Minn., with Roseau, if given sufficient patronage. There is also talk of forming a home company at Roseau and constructing the line.

The Western Electric Telephone company will connect its eastern and western systems by building a line between Albert Lea and Spring Valley, Minn.

The Iowa and Nebraska Telephone company of Spirit Lake, Ia., is arranging to build from Little Rock to Rock Rapids and Ellsworth, Ia., this spring. The company now owns 300 miles of toll line and four exchanges. The stock is nearly all owned in Spirit Lake.

The Perry Telephone company is arranging to establish a telephone exchange in Adel, Ia.

COMMUNICATIONS.

The Firman Patent.

To the Editor of the Western Electrician:

The attorneys for the Western Electric company (Bell manufacturers) having published a statement over their signature, which, by inference, indicates that the Firman patent covers all forms of multiple switchboards, and that this patent was upheld in their favor in a recent California suit, we desire to publicly announce that the Firman patent does not, in any manner whatsoever, affect the multiple transfer system of the switchboard of this company. We challenge a single particular in which the Firman patent claims refer to our devices.

WESTERN TELEPHONE CONSTRUCTION COMPANY.

Chicago, April 6, 1898.

Telephone Manufacturers.

To the Editor of the Western Electrician:

On March 26th the Western Electrician published an article under the signature of a gentleman who, the writer has good reason to believe, is officially connected with an independent telephone manufacturing company. However, the chance reader of the following passage in the article will think otherwise: "The business of a telephone manufacturing company is to sell apparatus. Operating companies do not need their assistance or direction in any particular whatever; as a rule, manufacturers are not more practical in exchange work than are promoters, and their advice is of little if any value," etc., etc. Does the gentleman realize that there are in this country more than thirty manufacturers of telephone appliances? And can he name a single "experienced telephone man" who would undertake to install an exchange system without depending a great deal on the information furnished by the manufacturer? I think not. H. P. CLAUSEN.

Chicago, April 4, 1898.

An appropriation of $1,500 has been asked for the construction of a telephone line from the United States lighthouse at Table Bluff, Cal., to connect with the general telephone system at Salmon Creek, Humboldt County, Cal.

How to Select a Telephone.

By H. P. Clausen.

For the inexperienced telephone-exchange manager it is a very difficult problem to select a telephone instrument best suited for his requirements. From the very beginning he has absolutely no confidence in the often conflicting statements made by rival manufacturers of telephone apparatus; therefore he relies much more on an opinion given by the user of a certain type than he does on the claims of the maker of that particular instrument. On first thought it may appear to be the best plan to first consult the user of an instrument under consideration and then consult the manufacturer; however, this is not always true, unless, perchance, the instrument required shall meet the same conditions exactly as those that are met by the instrument of which a practical trial has been made. Therefore if it become necessary to meet conditions not found in the system tested, an instrument constructed on a radically different plan may be required; in fact, the instrument required for one class of service might be almost useless if employed in connection with an instrument built to meet other conditions, though both may have been construced by the same maker, and in outward appearance differ in no respect whatever.

Suppose, however, that you have confidence in what a certain manufacturer might suggest, and that you ask him to quote a price on the telephone instrument it would be best to employ in connection with your system. The chances are that he will send you, with the price-list, a few simple questions, which you are supposed to answer. If you neglect to furnish the desired information, but send an order, you may be sure that the order will be entered for instruments such as are employed for ordinary service, and perhaps not at all suitable for your requirements. Therefore make it a rule to give the maker of an instrument all the information he wants relating to the manner and conditions under which you are going to operate the telephone. There is no better plan for getting just what you need, assuming, of course, that it is a responsible concern with which you are dealing.

Another suggestion for the "green" telephone manager is that it is far better when buying a telephone, the ins and outs of which he does not fully understand, to admit a little ignorance and let the salesman answer for possible mistakes, than to take the entire blame by exhibiting a superior knowledge of the apparatus under consideration.

When the necessity arises of purchasing a large number of telephones for exchange service the first cost generally receives the most consideration, whereas the maintenance expenditures that must develop sooner or later in a cheap grade of instruments seldom receive any attention at all. For use on the metallic-circuit system the telephone employed need not be quite as expensively constructed as the instrument that is required to give an equally efficient service on a ground-return or common-wire return (McCluer) system, for in the metallic-circuit system the telephone is not liable to many serious interferences that are met with in the common-return system. In contracting for a large number of telephones many points should be considered that may be relatively unimportant of themselves, but of considerable value in their relation to the conditions of operation and as bearing directly upon the question of first cost and operating expenses. The character and quality of the apparatus makes this unavoidable. Attention is therefore demanded for the essential features of construction. Let us examine the apparatus and consider the work it is intended to do.

The signaling apparatus of a telephone consists of the magneto-electric generator and a polarized magneto bell. The generator is employed at the telephone instrument for the purpose of enabling the user to conveniently generate an electric current sufficiently strong for the energizing of an electro magnet placed on the switchboard at the central office. The electro-magnet is arranged with an armature and the call recording shutter, and when properly adjusted requires only a very small amount of current, that is, about .01 of an ampere, or, more clearly, the current that passes through an ordinary telephone receiver connected in series with one cell of battery should throw the annunciator drop. The average line resistance of a metallic-circuit system usually is less than 300 ohms, and a magneto generator that will cause a call to be recorded over 10 times 300 ohms, that is, 3,000 ohms, would give an entirely satisfactory service. The generator, however, employed in connection with a ground-return system should be capable of sending a signaling current through a line resistance of at least 6,000 or 7,000 ohms, for the liability of poor ground connections, partial grounds on the line wires and other outside interference is great. Moreover, some manufacturers prefer to install a less sensitive annunciator drop at the central office, for the obvious purpose of preventing the recording of a call signal by every stray current that might pass over the line. The same rule, though somewhat modified, applies to the common-wire system.

The signal receiving apparatus of a telephone consists of two polarized electro-magnets, so set in relation to a movable armature that an attraction or repulsion of either pole will cause the armature to be moved to and fro. An extension of the armature is arranged for alternately striking one or the other of a pair of gongs, thus producing at the telephone the usual audible signal.

As a general rule the first care of the wary purchaser of a telephone is to receive an assurance that the instrument he desires to purchase will ring through a certain resistance, usually 10,000 ohms, but sometimes this requirement is raised to 30,000 and even 50,000 ohms resistance. To meet such extreme and only too often useless requirements, the manufacturer is compelled to make a more sensitive magneto ringer than is actually necessary for giving an efficient service. Though it may be true that it is some satisfaction to be able to ring a bell through a very large resistance, it is equally true that a talking service is far from satisfactory, if obtained at all, between the extremities of telephone circuits over 7,000 or 8,000 ohms in resistance. Normally, the magneto-ringer coils must be left in circuit with the line wires, and they are therefore always exposed to the damage that an accidental cross with highly charged wires might produce. For that reason the manager in selecting an instrument should make it a point to ascertain how much current the ringer coils will carry with safety, and not how small a fuse wire will protect the coils against burning out. The former, when known, will quickly help determine whether the fuse wire you must employ is of a sufficiently large size to warrant any certainty of action when the occasion arises.

The question has been asked by many: "What receiver is it best to employ, the single-pole or the double-pole?" Considering the first cost and the probable maintenance expense, there is little choice. The single-pole receiver costs less in the first place, but calls for more attention, whereas the double-pole receiver costs more but demands less attention when giving an every-day service.

There has been some discussion regarding the advisability of winding the receiver coils for a lower resistance for the purpose of eliminating somewhat the effects of extraneous disturbances, such as the inductive noises usually caused by high-tension currents on wires running parallel or passing over the telephone wires of a common-return exchange system. It may be said that there are in daily service double-pole receivers wound for six ohms resistance, which give very satisfactory results, where the regular 75 or 100-ohm receiver was not at all satisfactory. The telephone receiver is a very delicate instrument and requires to be well made, but it should not be made more sensitive than is really necessary for the proper reproduction of speech, for it is the voice current that is to be conveyed to the listener's ear, and not the pernicious wail of every wayward line of force.

The telephone transmitter is a very important part of the telephone, and good judgment should prevail in its selection. Outside appearances go for naught. The fact that an instrument talks well on making a general test does not indicate that it will continue to talk well. The American Bell Telephone company, with its numerous able engineers and immense corps of assistants, required over 10 years of experimenting before the present standard, "the solid back," was developed and adopted, together with its inherent faults.

Most transmitters may talk well for quite a long while, but, after some time, there is a gradual falling off in the general efficiency—the batteries require recharging more often than seems necessary, the receivers, the line wires, the switching appliances and the trouble men, are all called on to take a share of the difficulties an ailing transmitter may produce. The best plan to follow in the selection of a transmitter is to see that the containing case proper is made of solid metal. The diaphragm, if made of a metal, should be at least three inches in diameter, and if composed of a pressed-carbon disk it should not be less than two inches in diameter and well protected against accidental mechanical damage from the outside.

The office of an induction coil is to transform the variations of an electric current produced by a microphone, connected in series with the battery and the primary winding of the induction coil, into currents that have greater ability than the mere battery current would have, of forcing their way through large resistances. The primary winding of an induction coil should consist of as few turns of wire as may be consistent with the transmitter and battery employed. The secondary winding, it must be remembered, is a part of the receiving circuit, and as it offers a certain amount of resistance to the so-called voice currents, its resistance, or more properly, its apparent resistance, to the voice current should be comparatively low. Practically, in a telephone circuit the best results are obtained when the apparent resistance of the telephone receiver and the secondary winding of the induction coil employed are equal. However, it may be safely assumed that the induction coil, when employed as a part of the telephone, will cause less trouble and require less attention than any other part of the instrument.

The telephone employing a local battery should be equipped with an automatically operated switch that either connects or disconnects the battery as needed. The switch must also produce at the proper time either of two conditions in the telephone circuit, that is, normally a signaling or call receiving circuit, and a talking circuit when the instrument is required for a conversational purpose. For practical reasons a switch that is operated by removing the telephone receiver from its support is the best for an ordinary service. The purchaser that has some knowledge of mechanics will have no difficulty in selecting a good switch out of a lot of fairly good switches; however, the primary requirements may be mentioned. The telephone switch must perform exactly the same functions as any other kind of electrical switch by connecting the battery to the transmitter circuit and the secondary circuit to the line wires. The mechanical construction of a telephone switch should be such that the friction of all movable parts is reduced to a minimum. The body of the switch should be constructed so as to allow rigid fastening to the containing case, and the lever or receiver-supporting prong must be sufficiently strong for preventing any serious damage being done by every careless operator. The electrical requirements are that the contacts must always be made firm. Perhaps the least possible sliding motion is an advantage when the contacts are at all exposed to the collection of dust particles, but as the sliding motion creates a wear at the point of contact, it is doubtless better to select a hook wherein the contacts are made direct and properly protected against the accumulation of dust. It is needless to say that all contact points should consist of platinum and be fastened to the springs proper either by clamps, wedges or, what is the best plan, riveted fast directly to the springs.

Different people entertain widely differing opinions relating to the kind of wood that should be employed in building a telephone instrument. The old telephone manager, however, will not for a moment hesitate in recommending as the best a solid walnut cabinet, and with good reason, for the walnut woodwork will retain its true color always, whereas the originally bright color of the oak telephone is soon replaced by a flyspecked and a generally unclean appearance.

The writer's lack of faith in the serviceability of the lightning arresters such as are usually placed directly on the telephone will not permit him to make any special recommendations. However, the presence of a grounded plate near the line binding-posts, if mounted on a wood base, is a fire trap of the worst kind. Moreover, it does not offer the protection desired, for the lightning arresters should be mounted separately and on a non-combustible base in combinations with a fuse wire of the proper size for protecting the telephone. In many cases it is preferable to employ a fuse wire only, which, if properly constructed, offers ample protection against atmospheric discharges.

Telephone Legislation in Massachusetts.

[Special correspondence of the Western Electrician.]

Boston, April 1.—The lower branch of the state Legislature, after a heated debate, ordered to a third reading to-day a bill to place the telephone companies doing business in Massachusetts under the supervision of a Board of Gas and Electric-light Commissioners. This measure has created a great deal of discussion throughout the state and its passage was strongly opposed by the Bell Telephone people. The Boston Post stood behind the bill and used all of its influence to secure its adoption. The committee on mercantile affairs, five of the 11 members dissenting, reported the bill. It is entitled "An Act Relative to Charges and Service of Companies Engaged in Telephone Business," and contains the following provisions:

Section 1. All matters relating to the rates and service of companies engaged in the telephone business shall be under the supervision and control of the Board of Gas and Electric-light Commissioners. And said board shall have full power to recommend such change in the telephone rates and service as the public interest may require, and to inspect and examine the books, records and accounts of said companies, and to summon witnesses and send for persons and papers at such hearings as may be had before them. And said board shall have the same rights and powers in the premises as it now possesses in reference to similar complaints brought before it regarding gas and electric-light companies, except as otherwise provided in this act. And no increase in the rates of said companies shall be made without previous approval from said board.

Section 2. Upon the complaint in writing to said board by the mayor of any city or the selectmen of any town in which a telephone company is located or doing business within the limits of the commonwealth, or by twenty customers of any telephone company, in respect of the prices charged by said company for the use of telephone instruments or for messages sent by telephone, or of the quality of the service rendered by such company, the said board shall notify the company of such complaint by leaving a copy thereof at the office of the company, and shall thereupon, after such notice as the board may deem proper, give a public hearing or hearings to such petitioner or petitioners, and after said hearing or hearings may make such recommendation as the board deems just and proper concerning any reduction in the charges made by said company for the use of telephone instruments or for messages sent by telephone, or relating to any improvement that the board deems just and proper in the service rendered by said company; and said board shall recommend such further action in the premises as may seem just and proper to said board. The jurisdiction of said board hereby given shall extend to and embrace the prices charged by one telephone company to another telephone company as well as prices charged by any telephone company to any city, town or private customer.

Section 3. Every telephone corporation shall, at all times, on request, furnish to said board any information required by it concerning the condition, management and operation of its business, and particularly copies of all leases, contracts and agreements with subscribers or other telephone corporations, or otherwise, to which it is a party, and also with rates, charges and other facilities afforded to the public

Section 4. The said board shall, in its annual report to the Legislature, include reference to all proceedings that have taken place under the provisions of this act during the period covered by its said report, together with such suggestions as to the condition of affairs or the prices charged by telephone companies or the service rendered by such company as said board may deem appropriate.

The City Telephone company of New York city has been incorporated with a capital of $100,000, to operate a telegraph and telephone system in New York city and to Albany and Boston, and the intermediate places in New York, Massachusetts, Rhode Island and Connecticut; also on Long Island to Montauk Point, and to Jersey City and Philadelphia and intermediate places

Emerson Alternating-current Fan Motors.

The Emerson Electric Manufacturing company of St. Louis, Mo., is placing on the market a complete line of alternating-current fan motors both for desk use and ceiling fans. The desk fans are made in two sizes, 12 and 15-inch, and two styles of ceiling fans are made—one two-blade, making from 200 to 210 revolutions per minute, and being for 60-cycle systems; the other, a five-bladed type, making 500 to 600 revolutions per minute, being for high alternations from 125 to 133 cycles per second.

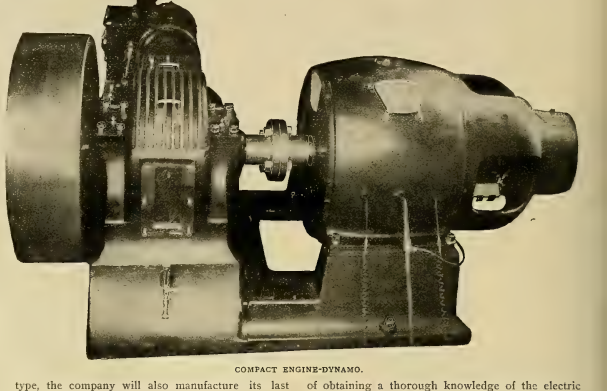
Fig. 1 shows the two-bladed ceiling fan for 60-cycle systems. This fan has a direct-acting, slow-speed induction motor without speed-reducing gear of any kind, and also without commutator or brushes. It is noiseless, the only wearing part being a single ball bearing, which is run in a cup of oil. After being placed in position this fan requires no attention for the entire season, if the oil-cup is filled at the beginning of the year. The finish of this fan is very tasteful and rich, the body of the fan being in expensive black enamel with gold decorations, hanger and trimmings being finished in highly polished and lacquered brass. This fan is regularly furnished for 12-foot ceilings without light fixture, but can be furnished promptly in nickel or oxidized copper finish with light fixtures for two, three or five lights, as ordered, and can also be furnished with hanger rods for any desired height of ceiling. The current consumption of this machine, running at the highest speed (210 revolutions per minute), is stated to be 125 watts. A second speed is also provided for by which the motor runs at 150 revolutions per minute, with a current consumption of 100 watts. This is the type machine which is regularly furnished. For special uses the company is prepared to furnish this machine with a current consumption of 150 watts on the high speed, giving a correspondingly large volume of air.

Fig. 2 gives an idea of the appearance of the five-bladed ceiling fan adapted for high-alternation systems of 125 to 133 cycles per second. In all mechanical features this fan is identical with the two-bladed fan, and only differs in the higher speed at which it runs and the different shape of the fan blades. The finish of this machine is identical with that of the C-F-38. These two types of ceiling fans are fully guaranteed by the manufacturers, who claim to have increased the amount of air set in motion by these fans from 33 1-3 to 40 per cent. over the ones manufactured by them last year.

In Fig. 3 is presented a rear view of the 1898 type of alternating-current fan motor manufactured by this company. The general appearance of the motor has been changed entirely from the former type, and the mechanical construction has been changed in a way which the manufacturers believe will be a decided improvement. The shaft of these fan motors is pressed firmly into the back cover and is made of half-inch bicycle tubing, which is case-hardened and ground accurately to size. The armature hub is composed of a larger piece of bicycle tubing into which is pressed at either end a brass bushing. This bushing is reamed out to accurately fit the hardened steel shaft. This shaft being of much larger size than has ever been used on fan motors in the past, and from the fact of its being hardened steel, will wear for an indefinite time, thus avoiding all rattle and noise. Another improvement lies in the switch plate, which is made of porcelain, the binding-post hang concealed, so that it is absolutely impossible for inexperienced persons to receive a shock in handling the motor. The 12-inch size of desk fan is carried regularly in stock for any voltage and number of alternations. The 12-inch motor is said to consume on the start from 65 to 70 watts, running at about 1,550 revolutions per minute. By turning the switch over to the position marked "on," the consumption of current is cut down to 50 watts, while the speed remains almost the same. While by moving the switch to the position marked "slow," the current consumption is cut down to about 35 watts and the speed to about 950 revolutions.

The 15-inch fan is carried regularly in stock for 7,200 and 16,000 alternations, and for 52 and 104 volts. Machines, however, can be furnished for any voltage or number of alternations. The current consumption of the 15-inch motor is 110 watts on the starting point with revolutions of about 1,550 per minute. Moving the switch over to the point marked "on" reduces the current consumption to 90 watts and the revolutions to about 1,500.

For the accommodation of such patrons as used the Emerson 1897 type of motor and prefer that type, the company will also manufacture its last year's type of motor, and is prepared to furnish either style promptly on short notice.



COMPACT ENGINE-DYNAMO.

Compact Engine-dynamo.

The Wadsworth Salt company has recently installed at its works at Wadsworth, Ohio, a neat and efficient lighting plant that is giving excellent satisfaction. The illustration shows the generating unit, composed of a 7 by 8-inch Weston Imperial engine and a 15-kilowatt, 125-volt, D type dynamo, made by the Card Electric company of Mansfield, Ohio. The armature and engine shaft are coupled together by a flange coupling, which permits of quick and easy separation, and is a desirable feature when floor space is not of great moment.

The engine and dynamo room is ample in size, nicely finished, with a handsome and convenient switchboard for manipulating the current about the works.

The engine and dynamo were first put together at Wadsworth without a hitch, and, when ready, made a run of 16 hours without a stop, hot box or trouble of any kind.

The Salt company is well pleased with its plant and already contemplates an extension.

Electrical Engineer's Correspondence School.

A new correspondence school of electrical instruction has been established by the Electrical Engineer of New York, although it will be carried on as a distinct enterprise, without reference to the policy of the journal. Herman A. Strauss, E. E., is the manager of the school, which is known as the Electrical Engineer Institute of Correspondence Instruction. The Engineer lends the weight of its influence to the new school and vouches for Mr. Strauss as a trained engineer and a practical teacher. The school is established "to enable anyone desirous of obtaining a thorough knowledge of the electric and allied arts to acquire it through the instrumentality of carefully prepared, printed lessons, supplemented by a system of confidential correspondence carried on between the student and the Institute, in which the student is at liberty to ask as many questions as he likes until he is satisfied that he thoroughly grasps every point in the lesson he is studying." Unlimited time is granted to the student to complete his course, and the terms are moderate. Each student will be a class by himself, sustaining direct personal relations with the instructor and advancing in his studies as his capability and time permit. The new Institute is not intended to be a competitor of established schools of electrical engineering, but it is desired to assist those who can only obtain a technical education by home study. The text-books deemed necessary are furnished without extra charge, and the Institute promises to deal generously with students in the matter of dropping, transferring or renewing memberships.

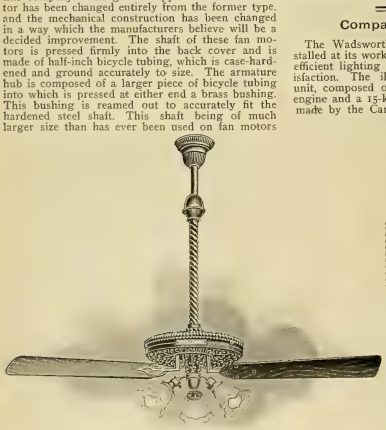


Fig. 1.

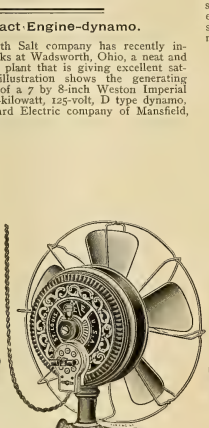


Fig. 3.

EMERSON ALTERNATING-CURRENT FAN MOTORS.

Fig. 2.

BOOK NOTES.

"Science Abstracts" is the name of a new English publication devoted to physics and electrical engineering that will doubtless prove valuable to students in these departments everywhere. It is well arranged, and as it is issued under the direction of the Institution of Electrical Engineers and the Physical Society of London, its standing is assured. The list of editors and abstractors contains many well-known names, and there is every probability that the new publication will prove a valuable acquisition.

Among the recent foreign publications of value may be mentioned Annuaire pour l'An 1898, publié par le Bureau des Logitudes, avec des Notices Scientifiques. Paris: Gauthier-Villars et Fils, imprimeurs-libraires du Bureau des Longitudes, Quai des Grands-Augustins, 55. This forms a yearly scientific publication, containing astronomical, geographical and statistical information, and a large number of physical tables, notably those relating to heat, acoustics, optics and electricity. It is a valuable compendium of accurate information for reference.

The American Electrical Directory, which replaces the Standard Electrical Directory, contains many changes besides that indicated in the title. For instance, it has been deemed advisable to separate the central-station directory from the street railway department. The latter has been eliminated from the present number and will be issued in a separate pamphlet, it is announced. This makes the directory purely an electric-lighting publication. In the first number under the new arrangement some interesting statistics are presented upon central-station and municipal-lighting plants.

The eleventh volume, third edition, of the electrotechnical publications from the house of Hartleben, at Leipsic, has been received. A chapter is devoted to steam, in its application to various motors. Water power and wind mills occupy the first pages, The dynamo is fully discussed and particular attention is given to regulators, circuits, systems of wiring, electric lighting and electric-lamp construction. The illustrations, which are profuse, are well executed, and embrace pretty much everything in the way of machines, lines and material, and add to the practical value of the book, making a valuable compendium for the electric-light man.

We are in receipt of a copy of Edward J. Houston's "Pocket Dictionary." This is the fourth and latest edition and is furnished in both cloth and full leather binding. This little book contains over 6,000 new electrical words, terms and phrases that have come into use since 1894. The former edition of Professor Houston's dictionary only contained 5,000 words, while the new edition contains 11,000 and about 15,000 definitions, and is the most complete and reliable electrical dictionary ever published. It is just the right size and in every way is a most admirable production. It is published by the American Technical Book company, 45 Vesey street, New York.

Berley's Universal Electrical Directory for 1898 contains the names of the members of the electrical and kindred industries throughout the world and a great deal of other valuable information.

The amount of work entailed in its compilation has considerably increased. It has been thoroughly revised, and the British alphabetical section now comprises about 9,918 distinct names, the Continental 7,872 names, the American 4,080 names and the Colonial 1,924 names, making a total of 23,974, approximately 1,136 names of individuals and firms more than were contained in the book for 1897.

For simplicity and facility of reference it is divided into four groups, namely, British, Continental, American and Colonial, which are again subdivided into alphabetical and classified sections, and in the case of the British a geographical section is given, making in all nine sub-divisions.

In addition to the new names incorporated in the present issue, much financial information, such as the telegraphic addresses and local telephone numbers, are given, and the total of pages added to the work is 70, as compared with that of 1897, making in all about 1,100 pages entirely of directory matter. It is claimed to be therefore the largest, as it is the oldest, electrical directory in the world.

In the preface the following statement will command attention:

> The one remarkable feature in electrical tramway schemes has been the introduction of American machinery, but when one remembers the extraordinary experience gained by our transatlantic friends in this branch of electrical engineering, it ought not to be surprising.

Missouri Franchise Law.

(From the St. Louis Republic.)

On motion of the attorney general the Supreme Court has advanced the suit from Kansas City to test the validity of the Julian franchise law, and arguments will be heard in the course of two weeks. In the ordinary course of business it is likely that the case will be decided some time in May.

This suit is of great importance to St. Louis, where no attention has been paid to the law, and franchises granted without any reference to its existence.

There is another case of exactly the same nature pending on appeal from the Circuit Court of St. Joseph. In this latter suit Judge Culver of the Buchanan County Circuit Court held that the law is unconstitutional, because the title does not indicate the scope of the law. The St. Joseph case, however, will be determined by the suit from Kansas City, as the latter has priority in the court.

Although many laws have been attacked of late years on account of faulty titles, the Supreme Court has not been disposed to deal with such objections in a technical sense, but has universally held that the title need not set forth the summary of the entire provisions of the law, but merely enough to indicate its nature.

In the opinion of Mr. Julian, author of the law, if the Supreme Court holds it to be valid, all the franchises granted contrary to its provisions will become utterly worthless, and in the future every franchise granted by a city will have to be first advertised for not less than 30 days in the city newspapers and then awarded to the highest responsible bidder.

Bluff City Railway.

Another link in the electric railways between Chicago and Milwaukee is about to be built by the Bluff City Electric Street Railway company of Chicago. The line will connect Highland Park and Waukegan, Ill., and will be about 17 miles long. It will have a single track, which will be laid with 65-pound steel rails. C. E. Loss, who is the president and principal stockholder of the company, has already begun the work of track construction, which will be of a substantial character.

The power house and car-barns will be built at Fort Sheridan. The plant will represent the latest ideas in electric-railway engineering, with alternating-current transmission and direct-current distribution from rotary transformers to the line. The engine, boilers and generators are now under contract for the initial installment of the plant. Three 250 horse power Cahall boilers of the Babcock & Wilcox water-tube type will supply steam, and the tandem compound engine will be of the Corliss design, built by Filer & Stowell, and rated at 400 horse power. Directly connected to the engine will be a 250-kilowatt, three-phase, 25-cycle, 5,500-volt generator, made by the General Electric company. The Arnold system will be used to connect engine and generator. A 125-kilowatt rotary transformer will be installed in the power house, and another of equal capacity in a sub-station eight miles north of Fort Sheridan.

Step-down static transformers at the power house and sub-station transform the alternating current of 5,500 volts from the generator to 380 volts. At this potential the three-phase current operates the motor side of the rotary transformer, generating direct current at 600 volts. The direct current is distributed by feeders in the usual manner to a No. 00 trolley line.

Each car will be 42 feet long with two trucks, and will be equipped with four General Electric motors of 35 horse power each. It is designed to run at a speed of 40 miles an hour, or each motor car can pull a loaded trailer at 25 miles an hour.

An interesting feature of the engineering work is the speed with which it was done. Within three weeks from the time the work was placed in the hands of Mr. B. J. Arnold, the designing engineer, the plans were perfected, specifications drawn and issued, bids received and contracts let.

Moses G. Farmer.

(From the London Electrical Review.)

It is very difficult for the mere men of the crowd to contemplate with other than wonder, or perhaps curiosity, the mental attitude of a man like Moses G. Farmer, who pursued science without a thought of the solid personal benefits to be derived from it. To day most of us, as soon as we have discovered some new fact or discerned some new bearing of an already ascertained fact, hasten to publish it, in order to obtain for ourselves priority. Indeed, in some countries, notably in France, there is an elaborate system of sealing papers, whereby a man may state in general terms something into which, perhaps, he has obtained some insight, and then, when someone else comes forward at a later date, he can produce from the archives of the Academy of Paris his hidden statement, which guarantees him that much-coveted priority. Vanity is doubtless at the root of this curious practice. This quality, for it is a quality, and a good one if it is properly balanced, is the last which we could possibly ascribe to Moses G. Farmer. In him the world had a clever, industrious worker, who observed, deduced and noted down facts, which, had they been published at the time, would have covered him with honor and renown. We can quite sympathize with this modesty, but to-day can see the pity of it, for had those notbooks been given to the world, applied electricity would, without doubt, have come more rapidly into prominence in the industries of mankind than it has done. It may be said that the new science has come on quite fast enough, but useful progress in the application and acquirement of knowledge cannot proceed too rapidly.

It would be a good thing for the rising generation of electrical engineers if a biography of Farmer could be placed in their hands. It would prove not only interesing and encouraging, but inspiring. In Farmer's work there was no cheap clap-trap, no striving after effects which would dazzle the multitude, no dashing about in order haply to light upon the fact of which he was in search, no rule-of-thumbism. He proceeded slowly and steadily, measuring his paces and calculating his distances, until he was able to gain the end he had in view.

It is sincerely to be hoped that Mr. Farmer's notebooks will be edited and published. Their contents are believed by those who have inspected them to consist of matter which was new science at that time. He was a great inventor, and deserves that certain discoveries which figure in those notebooks should be credited to him. The work of Farmer has passed unconsciously into the work of others, but had his individualism been more energetic, he would have been recognized during his life as one of the greatest leaders in the application of electricity.

Trade Catalogues in Foreign Languages.

So much has been said by American consuls and others interested in the extension of American foreign trade about the necessity of catalogues printed in the language of the country in which it is desired to do business, that a contribution on the other side of the question is of interest and importance. Such a contribution, from the manufacturer's point of view, is supplied by a letter written by Mr. E. A. Merrill, the manager of the New York office of McIntosh, Seymour & Co., to the National Association of Manufacturers. Mr. Merrill writes:

"At the same time that we wrot you we wrote a number of manufacturers with whom we are acquainted and who do a considerable export business. Their replies indicate such difference in opinion and practice in the matter that we believe it would be of advantage to the members of the association should you look into it further, not only with reference to the general question as to whether or not it pays to distribute circulars in foreign languages, but as to the further question as to how far this applies to different kinds of business.

"Take, for example, our own line of business. Our engines go to England, France, Germany, Belgium, Russia, Japan, Ceylon, South Africa, Australia, Brazil, Argentina, Venezuela, Mexico, Cuba, with occasional orders for smaller and less known countries. If we except the strictly speaking English countries, and also Japan, where the English language is spoken to so large an extent that it is unnecessary to consider any other language, there are still French, German, Russian and Spanish-speaking countries to reach, and with us the translation into any one of these languages of our catalogue is a serious matter, owing to the necessary use of technical terms and expressions which have absolutely no equivalent in those languages. Not only is the translation work a slow and expensive process, but the expense of printing is large and the expense of distribution and correspondence entailed is also large; so that any way we figure it the total expense would be a considerable burden, and thus far we have not been able to satisfy ourselves that the results would be commensurate with the cost.

"We presume there are many other manufacturers in our own and similar lines who have studied the same problem and whose attention is continually turned to it on account of the repeated statements of our consuls to the effect that other countries pursue this course and that a successful export business can only be built up by pursuing a similar policy. We would like to ascertain if it is a fact that other countries do pursue this policy in all lines, or whether as a matter of fact it may be true that this policy is pursued in the sale of what may be termed staple commodities—in other words, commodities that can be sold from samples or from catalogues. In our line of goods there is a further difference due to the fact that the number of individual orders is not large, the number of individual customers being comparatively small, but the amounts of the orders being quite considerable, so that we come in contact with comparatively large purchasers who are, as a rule, either themselves proficient in the use of the English language or whose engineers are proficient, many of them being secured from this country.

"We have gone into the matter somewhat at length, for the reason that should manufacturing concerns go into extensive advertising in foreign languages it would mean the expenditure of a great many thousands of dollars. For example, should we go into it thoroughly we should figure that it would mean an expenditure of not less than $4,000 or $5,000, an amount neither ourselves nor anybody else can afford to spend injudiciously or wastefully in export advertising.

"Another question we should like to be enlightened upon, and which has a bearing on this question, is as to the spread of the English language in foreign countries, especially as affecting trade relations. It has seemed to us that in the Spanish-American countries the use of English was making rapid strides in all branches which affect our business, and that there might ultimately be a positive advantage, although a temporary disadvantage, not to attempt carrying transactions too far."

The City Council of Dodgeville, Wis., has granted a franchise for electric lighting to W. H. Earl of Chicago.

CORRESPONDENCE.

New York Notes.

New York, April 4.—Edwin Knowles, a young man employed by the Edison company, was the victim of the first accident reported in this vicinity from the use of the chainless bicycle. He was an experienced rider, but his wheel became unmanageable at Bensonhurst, where he was riding with his father yesterday, and he was thrown to the ground, dying from a fractured skull within an hour.

At last week's meeting of the Rapid Transit Commission George L. Rives submitted the form of contract for the construction and operation of the underground railroad. The contract is extremely voluminous. Two hundred and fifty-nine sheets of drawings accompany the contract, exhibiting in great detail the work to be performed. These drawings and the specifications show a railroad of the highest grade. The contractors must undertake to run trains of two kinds—local and express trains. The local trains are to be run at an average speed, between stations, of not less than 14 miles an hour, and express trains at an average rate of speed of not less than 30 miles an hour. During the day trains are to be run to meet the reasonable requirements of the public. During two hours and a half of the night trains are to be run at intervals of not less than 10 minutes, and between the hours of 1 and and 5 a. m. they are to be run at intervals of not less than 15 minutes. The contract requires that the contractor shall supply rolling stock of a superior quality; that it shall be adequate to the requirements of the public; that schedules of the equipment shall be filed so as to make the lien of the city readily enforceable, and that the equipment shall be kept at all times in good order. It was resolved that the draft of the contract should be sent to the corporation counsel, as his approval is required by the statute.

Details of the great power house of the Metropolitan Street Railway company, on the East River, between Ninety-fifth and Ninety-sixth streets, are interesting. Contracts for Babcock & Wilcox boilers, Allis engines and General Electric generators have been let. The order for the boilers is said to be the largest single stationary boiler order ever placed, and calls for 58 of the Babcock & Wilcox wrought steel water-tube type. Each of these is to be rated at 250 horse power, with an ultimate capacity of 400 horse power. Shortly after the installation of these an order for 29 additional boilers will be placed. The engine order calls for 11 vertical cross-compound side-crank condensing engines, each direct-connected to an alternating-current generator placed between the two columns of the engine. The engines, as I gather from the Iron Age, will be of 4,000 nominal horse power each, but will have a maximum capacity of 6,600. The power house will be of brick with steel framing and trusses. It will occupy a space of about 200 by 280 feet. The building will be divided into halves, the boiler room occupying one half and the generating machinery and engines being in the other portion of the building. The two sections will be separated by a heavy wall. The side on which the boilers will be stationed will be divided into five floors. On the lower three floors the boilers will be stationed in two tiers, facing each other. The upper two stories will be formed into a steel coal-storage bin. This will extend over the entire building, and will have a capacity of about 9,000 tons. The floors will slant down toward the center, and from the lowest point in the center chutes will convey the coal to the three boiler floors. Automatic conveying machinery will take the coal from vessels at the dock in back of the building, and deliver it to any part of the bin. A smoke-stack, 350 feet high and 22 feet in diameter, will be situated in the center of this building. Large flues will connect the boilers with the stack, and in addition there will be a complete system of forced draft. The boilers will be placed in batteries of two with a five-foot passage between batteries. Ash-chutes will lead from each of the three boiler floors to the basement, whence the ashes will be conveyed by automatic machinery. The section of the building which will be occupied by the engines and generating machinery will have only one floor besides a basement and subway. The two platforms of the engines will all be connected, however, with a complete system of bridges and steps leading to them; this will give the effect of two additional floors. Each engine is to be connected to an independent air pump and condenser. These will be located in the basement of the engine room. In view of the magnitude of the plant, the piping system adopted is a most simple one. The steam pipe for each engine connects with a stand pipe in the boiler house, and this stand pipe, running in back of the boilers, connects with each. Placed as near to the engine as possible there is in each engine branch a combined separator and receiver. The exhaust pipe from each engine drops through the floor to a closed feed water heater, and then connects with the condenser. An atmospheric riser is provided for every four engines, and, when necessary, the exhaust can be [illegible] into the atmosphere. An electric crane of [illegible] span traverses the entire engine room.

Business is undoubtedly better. Inquiries are numerous, and builders of boilers, engines and electrical machinery have been doing considerable bidding during the last few weeks on the equipment of various electrical plants. The Metropolitan Electric company of Reading, Pa., has just awarded more than $60,000 worth of contracts.

Two new concerns, who will soon ask for bids, are the promoters of the proposed electric road connecting Atlantic City and Camden and the Gettysburg Transit company of Gettysburg, Pa. The former corporation is known as the New Jersey Electric Railway company and is incorporated for $3,000,000. The projectors are Atlantic City and Philadelphia capitalists. The latter company will apply for a charter on April 14th and will operate extensive electric railway lines as well as control the electric lighting of Gettysburg. It will be known as the People's Electric Light, Heat and Power company of Gettysburg. Philadelphia capitalists are at the head of the project.

Preparation for next month's electrical exhibition in Madison Square Garden is proceeding apace. The interest is widespread. Prof. R. B. Owens, director of the electrical work at the Omaha Exposition, beginning in June, has been specially instructed to visit this city in May and acquaint himself with the exhibits and the work being done. Many special features are being laid out. One is an offer of prizes for essays on the exhibition from the pupils of schools in New York and vicinity, not over 16 years of age. Another is a practical exhibit of the system of quick police communication developed by Chief McCullagh of this city. A third is a model of the Edison magnetic ore separator, built by Sigmund Bergmann, with samples of crushed ore and briquettes. A long list of judges for the telegraph tournament has been published, and it is said that the crack operators are already getting into training.

The Walker company has recently secured a handsome and commodious suite of offices on the sixteenth floor of the Commercial Cable building, at 18 and 20 Broad street. The suite includes a private hall, general offices, private offices for the officers of the company and all modern conveniences for the transaction of business. W. F. O.

Northwestern Notations.

Minneapolis, April 4.—A survey is to be made at once for the Minneapolis and Anoka suburban electric railway, and it is hoped to have the line in operation by the later summer months.

The Sac City (Ia.) Electric company has completed its canvass for stock subscriptions, and all the shares are taken. The company will be formally organized and steps taken to put in the plant.

The Electric and Water company of Little Falls, Minn., gave a reception at its power house to exhibit the improvements that have recently been completed.

A switch engine ran some freight cars off the end of a blind siding in Winona, Minn., into a tall electric-light tower, and completely wrecked it. The pole was broken in five pieces by the fall, and the guy wires snapped and some telephone wires broken. No one was hurt.

An independent electric-light plant will be installed in the Board of Trade building in Duluth, Minn.

A committee appointed by a citizens' meeting in Park River, N. D., recommends that the city erect and operate an electric-light plant.

A man claiming to be connected with the Chicago and Northwestern Railway company has been looking over the field in the vicinity of Elroy, Wis., with a view to building an electric line from Mauston, Wis., to Elroy. He says that lines will be built from Baraboo to Portage and from Baraboo to Kilbourn, to act as feeders to the Chicago and Northwestern.

A new charter is being prepared for Barnesville, Minn., to enable the town to vote bonds for electric lighting and other improvements.

Injunction proceedings have been begun at Grand Forks, N. D., to prevent the city from paying warrants for work done on the electric-light contract. The grounds on which the injunction is asked are that there is no money available for the purpose, that the city is beyond the debt limit, that no appropriation has been made for the purpose, and that the proposition has never been submitted to vote of the people.

Mr. Winslow may furnish an electric-light plant for Marble Rock, Ia.

The John Gund Brewing company's new plant at La Crosse, Wis., will be equipped with electric apparatus to operate all the machinery. The Pacific Electric company has the contract. It will include a 100 horse power generator and seven individual motors, from one to 30 horse power.

St. John's University at St. Cloud, Minn., will put in an electric-light plant of its own.

A Peoria, Ill., capitalist contemplates constructing an electric railway from the Hotel Orleans, through Spirit Lake, Ia., to Milford. He proposes to furnish electric lights and water also.

J. K. Tillotson, the promoter who is interested in electric lines at Oskosh, Wis., has received a denial from George W. Blabon of Philadelphia, that he is interested in any proposed trolley lines between Oshkosh and Berlin, Wis.

The council of Clarinda, Ia., has appointed a committee to devise some plan by which the city may become owner of an electric light plant. The city is up to the limit on bonds.

The Cudahy Packing company has awarded contracts for electric generators and motors to operate the packing plant now in course of construction at Sioux City, Ia. The contract calls for two generators, each with engine and steam supply of its own.

C. S. Weisse & Co. have been granted a franchise for an electric-light system at Sheboygan Falls, Wis.

The council of Rochester, Minn., is considering repairs to the boilers and engine of the electric-light plant, both of which are reported as defective.

J. C. Hubinger of Keokuk, Ia., is arranging to build an electric street-car line in Quincy, Ill.

There is talk of an electric-light plant for Milo, Iowa.

The Duluth Street Railway company, in answering the suit brought by the Lakeside Street Railway company at Duluth, Minn., to recover $12,416.52, which is alleged to have been unjustly charged the plaintiff, charges that the plaintiff company has refused to bear expenses which belonged to it, and they were therefore charged against its account. It names the vestibuling of cars required by law, and other items, and declares that the Lakeside company is really indebted to it to the amount of $25,496.85, for which it asks judgment.

Beside saving the city $125 per month for lighting, the municipal plant of Wadena, Minn., made a profit of $100 for the months of January and February.

Bussey, Ia., voted to grant a franchise for electric lighting to Caldwell & Co.

The electric-light company of Grundy Center, Ia., made a proposition to the council to increase the lights in the unlighted part of town rather than increase the present lights from 1,200 to 2,000 candle power.

The estimated cost of an electric-light plant for West Superior, Wis., is $75,000.

An electric-light wire came in contact with a gas fixture in a business house in Waterloo, Ia., and burned a hole through the pipe, igniting the gas. Had it not been discovered at once, a destructive fire might have resulted.

R. R. Pember proposes to build an electric railway from Sumner, Ia., to Arlington, via Maynard.

George H. Finn, who has been connected with the electrical department of the St. Paul Gas Light company, as manager, has been appointed manager of the New England Gas and Coke company of Boston, and will leave on April 15th.

Culver Bros. of Glenwood, Ia., have traded the Emerson mills for the electric-light plant. The mill property went in at $14,000 and the light plant at $15,000, Culver Bros. paying $1,000 in cash.

The gas and electric-light plant of Washington, Ia., has been declared a nuisance and residents of the neighborhood have brought suit for damages.

The Dyea Electric Light company has been incorporated at Roscoe, S. D., with $50,000 capital stock.

The Albert Lea Electric company of Albert Lea, Minn., has reduced meter rates 25 per cent., in response to a complaint from patrons. Furthermore, the meters are under the city's charge, and any patron can demand an investigation whenever he has a grievance.

The Water, Light and Power company of Watertown, S. D., has secured orders for over 1,000 lights and will put in a plant at once. For the past two years the city has been without electric light, the old plant that was put in in 1888 being worn out.

L. W. Boehner has bought the other interests in the Malvern, Ia., electric-light plant and is now sole owner. He contemplates some improvements.

The Mason City Electric company of Mason City, Ia., will move into larger quarters soon.

The city of Neola, Ia., is taking bids for furnishing an electric-light plant.

W. I. Gray & Co. of Minneapolis have made a proposition to the council of Stillwater, Minn., to furnish plans and specifications for an electric-light plant.

D. W. Hunt, formerly manager of the electric-light plant at Washington, Ia., died recently at Oskaloosa, Ia., of the grip.

A car of the Citizens' Traction company of Oshkosh, Wis., was struck by a Wisconsin Central train and the car wrecked. No one was hurt.

Truman B. Welch, superintendent of the Gas and Water company of Duluth, Minn., committed suicide by shooting himself through the head in a fit of melancholia. His affairs were all straight, his home life was happy, and there seemed to be no reason to lead him to take the step he did. He leaves a wife and two children.

An electric fire engine, using electricity instead of steam for pumping water, was tested in Des Moines, Ia., recently. The current is secured by tapping any wires that happen to be available. It was an entire success.

The Legislature of Iowa has passed a curative act legalizing the contract for a municipal electric-light plant to be put in by McCaskey & Holcomb.

Irving P. Lord and W. B. Baker of Waupaca, Wis., have been granted a franchise for an electric railway from Waupaca to the Chain o' Lakes. A similar franchise was recently granted to others, who failed to raise the necessary capital.

The Des Moines Union company will establish a powerful electric-light plant in the union depot which is being erected in Des Moines, Ia. It will furnish light for the depot and also for the yards.

The City Council of Chariton, Ia., has paid $1,000 on the judgment against the city for the electric-

light plant. The city has been behind on its funds, but the present council has been economical and is getting on a firm basis rapidly. The electric-light plant is on a paying basis, and the city debt is being steadily reduced.

William Wright of Chicago has bought the electric-light plant at Sioux Rapids, Ia., and will make a number of improvements. He will put in a new dynamo and erect a new power house at once.

The court has reopened the receivership of the National Electric Manufacturing company at Eau Claire, Wis., vacating orders of court of last December closing up the affairs. A large number of men and firms are made defendants. Some sensations are looked for in the development of the case.
C.

ELECTRIC LIGHTING.

Charles Williams, Joseph Parks and B. P. Williams have incorporated the Stuttgart (Ark.) Water and Electric Light company, with a capital stock of $10,000.

The city of Pine Bluff, Ark., has contracted with Wilber Harrison of Anderson, Ind., and N. Covington of Peru, Ind., for the erection of an electric-light plant.

During 1897 the number of central stations in France increased by 17. Direct-current plants predominate, and the dynamos are principally of French or Swiss manufacture.

Notice is given by the Lighthouse Board that on June 1st the fixed white light in the southerly tower of the Highlands of Navesink, entrance to New York harbor, will be permanently discontinued. There will be established in the tower, in place of the discontinued light, an electric light showing a white flash of about one-tenth of a second duration every five seconds. The height of the focal plane of the electric light above mean high water will be the same as that of the present light, 246 feet, and it is calculated that the light will be visible 22¼ nautical miles in clear weather, with the observer's eye 15 feet above the sea. Under certain conditions the reflection of the light in the sky will be visible at a greater distance.

ELECTRIC RAILWAYS.

It is stated that the stockholders of the Delaware (O.) Electric Railroad company have decided to offer the road to the citizens of the city for $37,500, the amount of its present indebtedness.

It is stated that the company promoting the electric street railroad at Parkersburg, Va., has arranged to issue bonds to the amount of $150,000 to construct this line. James M. Jackson of Parkersburg is one of the promoters of the enterprise.

The Chicago City Railway company has completed the construction work on the downtown trolley lines on Wabash avenue and State street, but has been prevented from putting up poles and wires on Michigan avenue, between Madison and Randolph streets, until an injunction shall have been dismissed.

Hirsch Bros. & Co. of Chicago, it is stated, recently bought the Salt Lake and Mercur railroad, a steam road opened in 1896 and running from Fairfield on the Oregon Short Line to the Mercur mining camp. The new owners of the road will change the motive power to electricity and will probably extend the road farther into the mining district.

The street railways of Marseilles will soon have 84 miles of track, and will be operated by electricity. A central station in the heart of the city will furnish current for all of the branches, and will develop at least 8,000 horse power. The fare for a ride of 5½ miles will be only two cents. Marseilles is ahead of all other French cities, not excepting Paris, in the matter of electric traction.

The South Bend and Elkhart, Ind., Electric Railway company has filed articles of incorporation, with a capital of $100,000. The incorporators are De Witt Dilworth, Arthur Kennedy and J. McM. Smith. It is proposed to build a line from Elkhart to Mishawaka, at the latter place to connect with the South Bend street railway, and at Elkhart to connect with the Goshen and Elkhart, now building.

The following paragraph is floating about, credited to the Youth's Companion. As far as the street names are concerned, it might have an actual basis of fact on an East Side line in Rochester, N. Y.: "'James,' shouted the conductor, as the trolley-car stopped at the street bearing that name. A man signaled him, the car stopped and the man alighted. A half-minute later the car neared another cross-street. 'William,' announced the conductor. Another man got out. The Irishman's eyes grew visibly larger. 'Alexander,' shouted the conductor. The third man left the car. When it had started on the Irishman arose and approached the conductor. 'Oi want to git out at Avnoo B,' he said. 'Me forrsht name is Michael.'"

Work is now progressing rapidly in effecting the change from moving cables to electrical transmission over the entire system of the Capital Traction company of Washington, D. C., and contracts have now been placed for the entire equipment of the station. The new power house will be a brick structure situated on the banks of the Chesapeake and Ohio Canal in Georgetown. It will be 298 feet deep, 62 feet wide and 65 feet high. The engine room will be about 135 by 60 feet, and will contain five horizontal tandem compound engines. They will be of the Allis Corliss type, rated at 400 horse power, and will run condensing in connection with Deane condensers. They will be direct-connected to 550-kilowatt General Electric railway generators, which will run 100 revolutions per minute at a pressure of 600 volts. The boiler room will cover about 162 by 60 feet in area. It will contain six batteries of double Cahall boilers. There will be a large coal-storage bin directly over the boilers, and the coal will be conveyed down to Roney stokers by a novel system of automatic conveying machinery. The coal will be conveyed from canal boats direct to the storage bins. A nine-foot steel chimney 150 feet high will rise from the center of the boiler room.

TELEGRAPH.

The War Department, through the Signal Office, received sealed proposals on April 7th for constructing a telegraph line from Fort Myer, Va., to Sheridan Point, Va., a distance of 16 miles. The government will furnish the wire, brackets, spikes, staples, insulators, etc., and the successful bidder must be prepared to furnish the poles and all the necessary tools and labor needed to construct a first-class line in every respect.

ELECTRICAL SECURITIES.

The action of the Louisville street-railway directors in announcing that dividends would probably be discounted on the common stock has caused disappointment among holders of those securities. The directors are charged with converting their own common-stock holdings into preferred shares before settling on the discontinuance of dividends on the common.

The General Electric company has filed the following statement of its condition January 1st with the commissioner of corporations at Boston: Assets, real estate, $659,113; cash and debts receivable, $6,560,727; manufactures, merchandise, etc., $3,896,873; patents, $8,000,000; debentures in treasury, $2,000,000; miscellaneous, $10,774,399; balance deficit, $11,308,111; total, $43,199,223; liabilities, capital stock, $34,712,000; debts and reserves, $8,487,223; total, $43,199,223.

MISCELLANEOUS.

During the quarter ended September 30, 1897, the United States exported carbons to the following destination and valuation: Vienna, Austria, $1,939.49; Bahia, Brazil, $615.18; Nuremberg, Germany, $18,705.85.

Sealed proposals are being invited until April 14th for the nnulment of an act granting the right to the ing Office at Washington, seven electric elevators. Detailed specifications and regulations with which bidders must comply may be obtained by addressing F. W. Palmer, public printer, Washington, D. C.

In Congress an amendment has been introduced for the annulment of an act granting right to the Des Moines Rapid Power company to construct and operate a power station on the Mississippi River, provided the work is not commenced within two years and completed within four years from February 24, 1898.

The people of East London, a town in South Africa, are said to be desirous that outside capital be employed to erect an electric-light and railway plant in their town. Other South African electrical projects are the erection of an electric-light plant at the Monastery diamond mine, Orange Free State, and the substitution of an electric railway for the present steam road at the Sheba gold mines.

The National Board of Fire Underwriters has issued in neat pamphlet form a "List of Electrical Fittings" which it pronounces "acceptable for use under the specifications given in the National Electrical Code." Mr. Merrill, the electrician of the board, explains that "some of the articles here classified, although not entirely reliable, are the best at present obtainable and must necessarily be used until the state of the art advances. Efforts are constantly being made to secure improvement in these and in all inferior devices."

The story is told of a man in London who conceived the idea of taking a long ride into the suburbs in an electric cab. The district to which he proposed to journey was comparatively sparsely populated, and an unlikely region in which to meet with return passengers. After the vehicle had proceeded a short distance it slowed and stopped. "The electric power," said the jehu, "has all gone." So the unsuspecting fare alighted, and, generously paying the apparently disappointed cabby his shilling, proceeded on his way. Looking back he saw the cab merrily plying for hire toward Oxford street again.

Final incorporation papers were issued on April 4th by the secretary of state at Springfield, Ill., to the American Wire company, with head offices at Chicago, and with a capital stock of $24,000,000. The subscribers to the stock are O. Owen, $4,000,000; William Thompson, $4,000,000; B. B. Ayres, $4,000,000; N. B. Harkness, $4,000,000; A. D. Waterman, $4,000,000, and P. A. Powers, $4,000,000. The directors are John W. Gates, John Lambert, Elbert H. Gary, Isaac L. Elwood, Charles Douglass, Frank B. Backes, H. S. Schuler, William Edenborn, Alfred Clifford, E. J. Buffington and S. H. Chisholm.

A special correspondent of the London Engineer says that the Japanese are diligent copyists of imported machinery. As to the quality of the machinery turned out by the Japanese, he says that if you ask a foreigner, he will tell you that they cannot make anything but rubbish; and on the strength of the strange methods they employ in dealing with their work, one may be pardoned for thinking that there might be some truth in that statement. Although probably nine-tenths of the Japanese-made machines are very worthless, the writer says that he has seen certain well-made engineering products turned out there. He thinks they are turning out better dynamos and electric motors than anything else in the engineering line. They make good boilers, and some of their engines are rather creditable. In shipbuilding they manage the plate-work extremely well, but they are no hands at riveting.

TRADE NEWS.

The American Sugar Refining company of Brooklyn, N. Y., is placing a new fireproof roof over its No. 1 boiler house. The roof will be fireproof, consisting of steel trusses covered with corrugated iron, and is being furnished by the Berlin Iron Bridge company of East Berlin, Conn.

The interesting plant of the Hartford Electric Light company, with its high-tension, alternating-current transmission from a distant water-power station, rotary transformers, low-tension, three-wire distribution and storage batteries, is the subject of an illustrated circular issued by the Electric Storage Battery company. The advantages of the battery are briefly set forth.

Notice is given that the firm of Taylor & Clark, dealers in electrical supplies at Philadelphia, has been dissolved by mutual consent. Louis P. Clark has purchased all the interest of Joseph P. Taylor in the business. All outstanding accounts will be payable to him and all debts will be assumed by him. The business will be continued at 510 Arch street, under the firm name of L. P. Clark & Co.

McCarthy Brothers & Ford have been appointed agents for the Sprague Electric company for Buffalo, N. Y. Other appointed agents are Morton, Reed & Co. for Baltimore, Md., Walker & Kepler for Philadelphia and the Pettingell-Andrews company for Boston. The Sprague automatic house elevators are being received with a great deal of favor, and many wealthy men of New York city and elsewhere are placing them in their houses. The machine in its construction embodies a number of highly ingenious features in its method of control, which is entirely automatic. By means of its devices the machine may be operated from any floor, or from the car itself.

The new edition of the catalogue of the Pelton Water Wheel company of San Francisco and New York is a mine of information for all interested in the utilization of water power, by electrical transmission or otherwise, especially where a stream of only small volume but considerable head is available. The Pelton wheel has played a conspicuous part in the development of the water powers of the West, and it is also used extensively in other parts of the United States and in foreign countries. It is said that 9,000 Pelton wheels are now in operation in all parts of the world. The catalogue describes fully the Pelton system of power and its applications. Much attention is given to the electrical transmission of power in connection with the Pelton system, and a long list of electric-power installations is published. The catalogue contains a large amount of general information of value to the engineer and includes a special notice warning prospective purchasers from infringing the Pelton patents.

The extent of the demand for electrically illuminated signs and street-advertising designs is shown by the fact that the Chase Electric Sign company has been organized in Chicago to make this type of signs exclusively. Charles A. Chase, the president, has been brought up in the sign business, being formerly connected with the B. F. Chase company, which was, a few years ago, one of the largest sign-making concerns in the city. He has also a taste for photography and electrical projection, being the inventor of the very interesting Chase electric cyclorama, described in the Western Electrician over two years ago, which has attracted considerable attention at home and abroad. Mr. Chase has made electric signs a specialty for several years, and now he is giving his entire attention to them. A. P. Peck, the manager of the company, is a practical electrician, who brings to the company the benefit

of his technical experience. The company, which has a shop at 175 Madison street and is doing a good trade, carries in stock a 16-inch letter and makes all sorts of special designs, signs and decorations. It uses a special waterproof socket, and is prepared to figure on electric-sign work of any character.

Among the foreign orders recently received by the Walker company may be mentioned 20 double No. 3-S street-car equipments, three single No. 3-S equipments and 18 double No. 3-N equipments for Paris, besides four 150-kilowatt belted generators with two generator panels. Bagnall & Hilles of Yokohama have ordered two 25-kilowatt direct-connected generators for Singapore. Recent domestic orders include two 150-kilowatt three-phase synchronous motors for the Lachine Rapids Power company, a 700-kilowatt alternator, single-phase, for the Buffalo and Niagara Falls Electric Light and Power company, two 400-kilowatt, belt-driven generators for the Syracuse Construction company, and one 120-kilowatt belted generator for the Northern Electric company of Baltimore. The Norton and Attleboro Railroad company of Attleboro, Mass., has purchased four double No. 4-A-S and two double No. 5-S equipments, besides a 250-kilowatt direct-connected railway generator. Besides the generator above referred to, the Northern Electric company of Baltimore has ordered 100 Walker arc lamps, making in all 300 in three months. The Walker company has also recently taken a contract from the government to build three disappearing gun carriages for eight-inch rifles; these carriages are to be of the Crozier type, '96 model.

BUSINESS.

The price-list of the Partridge Carbon company of Sandusky, O., gives a complete list of the prices for the many types and sizes of motor and dynamo brushes made by the company. It is valuable for reference.

Herman Andrae, vice-president of the Julius Andrae & Sons company, Milwaukee, was in Chicago last week. Mr. Andrae reports a prosperous business and states the prospects for his company were never better.

The new alternating enclosed arc lamp built by the Jandus Electric company is being called for in a way that shows appreciation by central-station managers. The lamp has a range of voltage from 100 to 120 and burns singly 100 hours on one pair of carbons. It is said to be noiseless and economical in current consumption. The Chicago office is at 753 Monadnock building. A catalogue is sent.

W. R. Garton has just completed arrangements to represent the United Electric Improvement company of Philadelphia in Chicago. This company makes all kinds of generators and motors for direct current and alternating current, as well as transformers and arc and incandescent lamps and sockets. It also manufactures a complete line of standard incandescent lamps, known as the U. E. I lamps.

The Michigan Pipe company is sending out with its compliments the catalogue of the National Cycle Manufacturing company of Bay City, Mich. Henry B. Smith, the secretary and treasurer of the Michigan Pipe company, is president of the National Cycle Manufacturing company. The motto of the latter is: "A National rider never changes his mount." The catalogue is a decidedly attractive one.

General Manager A. B. Clements of the Atlantic Alcatraz Asphalt company of New York reports that his company is having unusual calls for its product of late in the electrical line. It has recently made large shipments to many of the larger manufacturers and street-railway plants in various portions of the central and western states. It makes a grade of paint which is particularly adapted for outside structural iron work, such as the painting of trolley poles, electric-light poles, etc.

A descriptive pamphlet just issued tells all about the improved Garton lightning arresters manufactured by the Garton-Daniels Electric company of Keokuk, Iowa. The company is enjoying a fine business. Its goods are becoming more thoroughly established, are being used by manufacturers of generators and motors, and by a large number of the leading street railways and electric-light companies. The company also sells a large number of lightning arresters for protection of stationary motors, the Garton proving well suited for this purpose.

The rapid increase in the number of independent telephone exchanges has made the telephone-supply business a very important item in the business of all of the electrical supply companies. One of the items used by the telephone companies for which there has been quite a large demand is that of rubber-covered telephone cables. The Paranite telephone cables, which are being sold in the West by the Electric Appliance company, are securing, it is said, a high reputation among telephone people. The Electric Appliance company is in a position to make the most prompt delivery on these telephone cables, for the reason that it represents the only rubber-covered wire factory located in the West. The Electric Appliance company is thus enabled to ship any ordinary order for special telephone cables from the Indiana factory within a very few days after receipt, which makes an unusually prompt delivery for this class of material. The Electric Appliance company is always pleased to submit samples at any time.

ILLUSTRATED ELECTRICAL PATENT RECORD.

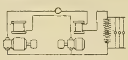
Issued March 29, 1898.

601,233. System of Electrical Distribution. William L. Bliss, Brooklyn, N. Y. Application filed October 14, 1897.

The method of controlling the current and electromotive force of a dynamo described consists in demagnetizing the field of the dynamo as the speed and electromotive force of the dynamo increase by means of an auxiliary counter electromotive force, which increases as the speed and electromotive force of the dynamo increase and which is connected in series with the primary exciting field coil of the dynamo.

601,263. Combined Rail Joint and Bond. Herbert R. Keithley, New York, N. Y. Application filed January 3, 1898.

A single metallic piece is forged around the meeting ends of two rails, and a bonding plate interposed between the rails and joining piece.



NO. 601,233

601,268. Electric Arc Lamp. Philip F. Krug, New York, N. Y. Application filed January 7, 1897.

A stand is provided with a base having a series of sockets or recesses and with slotted sides; a supporting arm is provided with a movable fulcrum guided in the slots of the stand; carbon holders are supported from the arm, and a set screw for adjusting the arm and the fulcrum, the lower end of the set screw being adapted to engage in one of the sockets or recesses.

601,276. Electric Switch. Ocron S. Platt, Bridgeport, Conn. Application filed February 2, 1897.

A base portion is provided with circuit terminals; a movable contact bar is arranged by its movements to electrically connect and disconnect the terminals; independent spring mechanisms are provided, one normally under compression and the other relatively normally uncompressed, and means employed for compressing the uncompressed spring and releasing the compressed spring to throw the contact bar into and out of engagement with the terminals.

601,286. Fusible Cutout. Ferdinand Schwedtmann, St. Louis, Mo. Application filed May 6, 1897.

The device comprises a suitable box or casing of insulating material, line wire terminals carried thereby, a removable fuse-carrying member in box or casing, fuse terminals carried by the fuse-carrying member and adapted to be put into electrical communication with the line-wire terminals, and a removable protecting cover for the line wire terminals at the side of the casing opposite the fuse-carrying member.

601,301. Safety Device for Electric Elevators. John D. Ihlder, Yonkers, N. Y. Application filed October 15, 1896.

Provision is made for the combination with the car and motor therefor, of a potential switch arranged in the circuit of the motor, and a shunt circuit including the magnet of the potential switch and the magnet of the safety brake device.

601,318. Regulator for Organs having Electrical Air Pumps. Levi K. Fuller, Brattleboro, Vt. Application filed July 20, 1895.

A wind conductor communicates with the air chamber of an organ and with the external air, and an air pump is located in the wind conductor. An electric motor operates the air pump in combination with a regulator for regulating the volumetric capacity of the air passage between the air chamber and the mouth of the wind conductor, and means controlled by the organist for governing the regulator.

601,351. Electric Lighter for Gas Burners. Ladislas V. Lewitzki, Brussels, Belgium. Application filed April 15, 1897.

An electric circuit includes the solenoid and igniter, and means, such as indented rings and a pin on the core, for moving the valve to an open or a closed position upon movement of the solenoid core, are described.

601,357. Means for Supporting Electric Wires. Benjamin Du Bois Smock, Wickatunk, N. J. Application filed February 10, 1897.

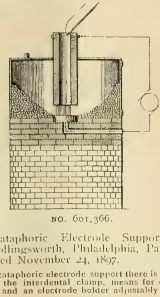
The line supports are secured to the bars and each consists of a rod provided at one end with a hook integral therewith and covered with insulating material, and the end of the hook being screw threaded and provided with a nut, the opposite end of the rod being adapted to pass through openings in the bars and being also provided with a nut.

601,366. Method of and Apparatus for Producing Calcium Carbide. Corydon L. Wilson, Charles Muma, John W. Unger, Henry Schneckloth, Amos P. Brosius and Joseph C. Kuchel, Holstein, Iowa. Application filed February 13, 1897.

The process consists in first causing the base and sides of the furnace, or the receptacle in which the process is carried on, to be lined with calcium carbide in granular form, and then causing a mixture of lime and carbon, to be fed into the space between the electrodes or the arc, so that the molten product may run into the base and sides so covered with calcium carbide.

601,367. Electric Furnace for Manufacturing Calcium Carbide. Corydon L. Wilson, Charles Muma, John W. Unger, Henry Schneckloth, Amos P. Brosius and Joseph C. Kuchel, Holstein, Iowa. Application filed February 13, 1897. Renewed February 4, 1898.

An electric furnace for producing calcium carbide is described, comprising a base, an electrode mounted in the base, a second electrode slidingly supported above the base, and having a number of longitudinal openings extended therethrough, a source of electrical supply connected with the electrode, a block of insulating material fixed to the upper electrode, and also provided with a number of longitudinal openings arranged to coincide with the openings in the electrode, so that a number of sticks of lime and carbon may be fed manually to the space between the electrodes, the upper and lower electrodes being so arranged that the sticks passed through the upper electrode will rest upon the lower electrode until melted, when they are free to run from between the electrodes, and means for raising and lowering the electrode and insulator jointly.



NO. 601,366.

601,396. Cataphoric Electrode Support. Merrill W. Hollingsworth, Philadelphia, Pa. Application filed November 24, 1897.

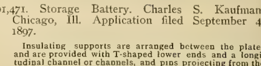
In a cataphoric electrode support there is the combination of the interdental clamp, means for operating the clamp, and an electrode holder adjustably connected to the means.

601,412. Wire Holder. Frank Canfield, Boulder, Colo. Application filed October 23, 1897.

A support for the wires of an electrical circuit may consist of the combination of a link composed of vulcanized fiber or other like non-conductor, a saddle of rubber or other like non-conducting substance having jaws for embracing the conductor, and a key or pin for clamping the conductor within the saddle.

601,454. Clamping Buckle for Electric Line Wires. Augustus H. Weikman, Palmyra, N. J. Application filed December 8, 1897.

The elastic fulcrum wire is adapted to embrace an insulator and have open projecting ends, in combination with a lever pivotally connected therewith and a clamping bail adapted to bend the line wire over the projecting ends of the fulcrum wire, and bind the line wire to the insulator.



NO. 601,492.

601,458. Electric Railbond. Frederick W. Atkinson, Chicago, Ill. Application filed October 4, 1897.

This device consists of two or more strips or wires which are bent together into two angles to approximate the form of the letter Z and terminally held together in the same plane by securing rivets.

601,471. Storage Battery. Charles S. Kaufman, Chicago, Ill. Application filed September 4, 1897.

Insulating supports are arranged between the plates and are provided with T-shaped lower ends and a longitudinal channel or channels, and pins projecting from the faces of some of the plates with their ends received into the grooves or channels in the insulating supports.

601,482. Electric Railway Signaling System. Barney Samuels, St. Joseph, Mo. Application filed May 6, 1896.

The railway signal described comprises a casing having holes or openings therein, a rod or arm rotatably mounted in the casing and having disks thereon adapted to normally cover the openings, a magnet and its armature adapted to rotate the rod or arm, an electric circuit adapted to energize the magnet, a hook arm on the rod or arm adapted to open the circuit to the magnet during the rotation of the rod or arm, and means for holding the disks away from the openings, whereby the circuit is kept open.

601,492. Automatic Cut-out. Henry F. Blackwell, Jr., Brooklyn, N. Y. Application filed August 28, 1897.

An automatic cut-out for an electric circuit is described comprising a spring-actuated arm forming a conductor, a link connected at one end to the arm and at the other end to a part insulated from the arm and a carbon point in the circuit and engaging with the link and adapted to separate the link when heated by an excessive current.

601,585. Electric Heater. James F. McElroy, Albany, N. Y. Application filed February 14, 1895.

Provision is made for the combination of supporting brackets having square openings therein, a squared spindle carried by the brackets and placed in the openings, a core of insulating material having a square perforation adapted to be placed on the spindle, a coiled resistance on the insulating material, and means for holding the same in position.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, APRIL 16, 1898. No. 16

A Modern Pressroom.

One of the most interesting installations of machinery in Chicago to all attracted by the nicety of mechanical applications and the ingenuity of labor-saving devices is the plant in the new pressroom of the Chicago Record and Chicago Daily News on Fifth avenue. Differing from many newspaper pressrooms, this one is clean and well lighted, and, although it is a busy place, visitors are received between the hours of three and four in the afternoon. The pictures accompanying this article show some of the interesting features of the plant, but one should see it in operation to appreciate the admirable perfection and development of the equipment. The younger readers of the Western Electrician, in particular, will find a visit to the Record pressroom instructive.

It should be understood that the Record and News, although entirely distinct in editorial control, are issued from the same mechanical plant, which is under the superintendence of Mr. Irving Stone, representing Mr. Lawson, the owner of the two properties. The newspapers have large circulations and print from 10 to 16 pages a day each, and the printing plant which Mr. Stone directs is a very large one, consuming, at the present time, 90 tons of paper and three barrels of ink a day. The new plant, which forms the subject of this article, is an addition to the older equipment and in it Mr. Stone, with the liberal backing of Mr. Lawson, has developed his ideas of what an up-to-date newspaper printing plant should be. Mr. Stone is at once a practical printer and a really gifted mechanician, and his work shows that his reputation among newspaper makers has been deservedly won.

The new plant is two-storied, occupying a basement and ground-floor store. A photographic view, taken in the latter, is reproduced in Fig. 1. The main equipment consists of two Hoe quadruple perfecting presses, numbered 9 and 10. The nearer press is shown "threaded" from the rolls of paper in the basement, as when an edition is being run off. The presses are electrically driven, and the large motor-controlling rheostats are placed in the balcony shown at the right in the general view and in greater detail in the picture (Fig. 2) on the next page. Direct current at 220 volts is obtained from the Daily News' isolated plant or from the Edison street mains. The switchboard is shown under the balcony in Fig. 2. The driving motors are located under the presses, in the basement. There are two for each press—a main driving motor and a smaller slow-speed machine to manipulate the press in "making ready." (The presses are practically duplicates of each other, and a description of one will serve for both.) The large motor is mounted on piers of masonry, and the smaller one is attached to the frame of the press. The presses themselves are installed on girder supports, resting directly on huge timbers, which take up the vibration so well that it is difficult when standing on the floor in another room to feel the presses at work. This arrangement makes a double-deck affair of the press-room. Metal grating in the floor-

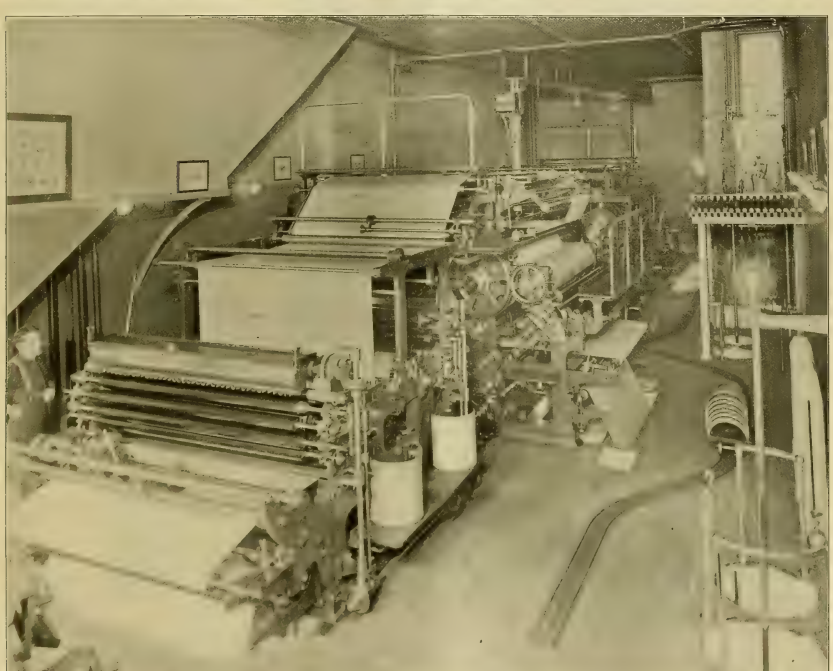


FIG. 1. A MODERN PRESSROOM—GENERAL VIEW.

ing in and about the presses add to the cleanliness of the machines, largely decrease the danger from fire and give greater circulation of air and light. The relative position and connections of the motors are shown in Figs. 3 and 4 (pages 223 and 224). The former shows the pinion side of the larger motor and the direct spur gearing, the latter the commutator side and the connection of the smaller motor, in which worm gearing is employed.

Perhaps the most important feature of the plant is Mr. Stone's electro-pneumatic system of motor control. Compressed air is used to operate the contact arms of the rheostats, and at a number of convenient points on each press air-valves and push-buttons are located. Such a point is shown in Fig. 5 (page 225). The hand shown is manipulating the handle of an air-cock which controls, through the specially constructed rheostat, the slow-speed motor which is used in "dressing the press" or making ready to run off an edition. This valve is constructed with three inlets and an exhaust, and can be set, first, to run the press slowly; second, to stop the press, or, third, to cause the air to go through a by-pass in such a manner that the press cannot be started from any other point. This last position gives a valuable element of safety, as when several men are working around the press any one of them can set an adjacent valve so that none of the others can start up the machine when it would be dangerous to do so. Below the air-valve for the small motor is shown, in Fig. 5, one of the plates from which the press operators control the large driving

motor. There is an "on" and an "off" push controlling the pneumatic apparatus on the back of the rheostat represented diagrammatically in Fig. 6 (page 225), by which the large motor is gradually started or stopped. Between these air-valves is an emergency electric push-button, by which the press can be stopped in a very few seconds. These big presses have a capacity of turning out 25,000 printed and folded 12-page papers an hour and they run at great speed. So when the paper breaks or other mishap occurs the trouble increases with extraordinary rapidity unless a very quick stop is made.

To consider now the electrical and electro-pneumatic equipment of these printing-presses in greater detail, it may be stated that the large motor is a 32-kilowatt four-pole Gibbs machine with a commutated compound winding sufficient to give an increased starting torque, which is short-circuited when the starting resistance is cut out, leaving the motor with plain shunt winding. The armature has a two-circuit series winding, and but two sets

FIG. 2. A MODERN PRESSROOM.—MOTOR SWITCHBOARD AND RHEOSTATS

of brushes are needed. The normal speed is 615 revolutions per minute. The small motor is of special design and of about four kilowatts capacity. It has six poles and a magnetic circuit of steel. Its armature has a two-circuit series winding and it has only two sets of brushes. The normal speed is about 300 revolutions per minute.

The speed of the large motor is governed by means of the rheostat by cutting out resistance in the armature circuit and increasing the voltage across the brushes, when the rheostat is short-circuited the speed is further increased by the introduction of resistance in the field circuit by means of a field regulator.

The speed of the small motor is controlled entirely by the rheostat model. The rheostat arm is operated by compressed air by means of five four-way valves (see Fig. 3) situated at different parts of the press. A small air cylinder and a similar cylinder filled with oil are placed side by side, on the face of the right-hand rheostat fronting the spectator in Fig. 2. There are, as will be seen, two of these equipments on the same rheostat, one for each press. The oil filled cylinder acts as a dash-pot to prevent any too sudden movement of the rheostat arm.

A somewhat different and more elaborate method is employed for the pneumatic control of the large motor. At the rear of the rheostat are placed three brass cylinders (see diagram, Fig. 6). The middle one contains a piston, connected by rack and pinion to the shaft carrying the rheostat arm on the face of the rheostat. It is filled with water, above and below the piston. The auxiliary cylinders are connected to it, one at the top and the other at the bottom. When the air pressure in one cylinder is released by pressing on one of the valves the pressure in the other forces the water into the middle cylinder from above, say, the reduced pressure in the other allowing the water to flow out from the bottom of the middle cylinder. Thus the piston is given a downward movement until all the water from the actuating cylinder has passed into the middle cylinder and the rheostat arm is at full-speed position. A rubber ball floats on the water in the outer cylinders and acts as a check valve by dropping into a valve-seat at the bottom of the cylinder, preventing any further pressure on the piston. In order to bring the motor to rest the air pressure on the outer cylinder now filled with water is increased above that of the outer cylinder now empty, and the water flows between the two cylinders in the opposite direction, tending to establish an equilibrium, and carries the piston with it, which turns the rheostat arm in the reverse direction, cutting in resistance and slowing the speed of the motor. The object of using water in the cylinders is to produce a uniform velocity of the rheostat arm. The auxiliary or air cylinders are connected directly with a tank which is kept at a constant pressure, and in order to reduce the pressure of one of the auxiliary cylinders a valve is opened, which allows the pressure to escape to the atmosphere, and a displacement of the water follows as above described. These exhaust pipes are carried to the "on" and "off" push-button valves on different parts of the press.

The "emergency" push-button is part of an electrical device and is in series with the field circuit of the large motor. The push-button circuit is also in shunt with an electro-magnet of such resistance that current does not flow through it unless the push-button circuit is opened by pushing a button, when part of the current is forced through the electro-magnet, energizing it and attracting an armature which releases two springs on the face of the rheostat attached to the switch opening the main circuit leading to the motor, and in so doing it also opens an exhaust valve which operates one of the auxiliary air cylinders, bringing the rheostat back to starting position. But on returning to starting position, the rheostat arm is forced against a double-seated valve, which admits air to a small cylinder placed on the lower left-hand corner of the face of the rheostat, which in turn forces up its piston, which closes the main switch again, and at the same time actuates upon a toggle which moves or kicks the rheostat arm slightly ahead to allow the double-seated valve to return to its normal position and release the pressure from the small cylinder, which operates in closing the main switch.

While this method of pneumatically controlling motor rheostats is rather complicated, it has proved efficient, very convenient and time and labor-saving. No skill is required to accelerate the motors, as the work is done automatically. The system requires two motors (and it should have been stated before that in starting the large motor the slow-speed motor is automatically cut out), but the results obtained are thought to amply compensate for the increased outlay.

The motors used are of the Gibbs type, and George Gibbs did much to assist Mr. Stone in his work. Kohler Brothers, who sold the motors, also took great interest in the plant, which may be said of every electrical man who has seen it. The Cutler-Hammer Manufacturing company built the rheostats after Mr. Stone's designs.

Of many special and novel features in this interesting plant, only a few can be mentioned here. One is the paper hoist and carrier which, rising between the presses, takes the folded papers and delivers them at the mailing table a hundred feet away perhaps. The hoist is pulled up by a wire rope, and in Fig. 1 it is shown near the top of its travel with a bunch of 150 papers in it. It is operated by an electric motor in the basement, a foot-push at the operator's command throwing in a clutch which communicates the motion of the motor to an ingenius attachment which pulls the hoist to the ceiling and lets it drop easily back. The hoist pauses at the top long enough for an automatic device to transfer the bunch of papers to a moving endless belt, driven by another motor, which carries the papers around a corner to their destination.

Another feature which is unique is the magazine reels, which are loaded with the great rolls of paper, so that 60,000 16-page papers can be run off a press without stopping the machine. Each press has two magazine reels, each reel having a capacity of four rolls of paper. From the storeroom narrow-gauge tracks run to the reels, which are placed in the basement under the press. The roll of paper is easily pushed on a little car over the track to a sliding platform which travels under the reel. Compressed air moves a plunger which "chucks" the huge roll between the centers of one arm of the reel; the reel is given a quarter-turn and another roll is put in place. This operation is repeated until the reel is loaded with a charge of four rolls. Mr. Stone is now planning to attach electric motors to these reels, so that the time and labor of turning them by hand may be saved.

As the presses extend through two stories, the superintendent set himself at work to devise means of getting about, without consuming time running up and down stairs. It was easy enough to get down by cutting a hole through the floor and sliding down a pole in it, but getting up was a different matter. Mr. Stone has met the difficulty by devising man-chutes. He is seen coming up in one in Fig. 2, while the steel sliding-pole is shown at the left. These man-hoists or elevators are automatically operated by compressed air. A pressman who wants to go to the upper story steps on the round platform of a chute, and his weight trips an air valve operating a piston, which shoots him to the floor above, and then easily returns to its original position for the next passenger. There are four sets of poles and chutes, and they make the presses fully as convenient to work upon as though they were arranged in the ordinary shape.

It is important, as the paper passes through the press, that the tension should be kept uniform. When the press gets up to speed a little brass governor automatically controls the tension. The governor has leading from it compressed-air pipes, which connect with a sensitive mechanism which operates a pressure plate. The plate presses constantly against the paper web. If the tension loosens this plate moves up and tightens the web; if the tension grows too tight the plate falls back and the tension is relieved, and at the same time electric lights in red bulbs begin glowing as a danger signal. The pressman knows that the tightness in the web is caused by a hot box in all probability on the magazine reel. He gives the screwcap of the lubricating cups a slight turn and the bearing cools off, the red lights die out, and the little governor picks up the tension again.

The Electric Light company of Avoca, Ia., contemplates buying a new dynamo.

Regulation and Protection of the Electric Motor.[1]

By Harry H. Cutler.

Electric transmission of power is fast becoming recognized as capable of almost universal application to all kinds of machinery. Scarcely a meeting of manufacturers, trade associations or engineering societies takes place where something of a favorable nature is not said about this rapidly growing and important industry. It can be truthfully stated, however, that the public is only just beginning to recognize the adaptability of the electric motor, and that an enormous demand awaits it in the near future.

The introduction of the electric motor into general use has not been as rapid as is generally supposed. Seventeen years ago the writer took for the subject of his graduation thesis "The Losses in the Transmission of Power by Means of Shafting and Belts." The results obtained were exceedingly interesting, and it might not be out of place here to mention some of them.

It was found that five-sixths of the power consumed by the engine was absorbed in the belts and shafting of the machine shop, and the very best result obtained with every machine in the shop running full—something which never occurs in practice—was an efficiency of about 30 per cent. The following deductions were then made from these results:

Attention was called to the saving which would ensue if power could be produced at each machine by means of a miniature steam engine or electrical machine, as illustrated by the low efficiency obtained in these experiments, the power to be transmitted by pipes in the form of superheated steam, or by wires conveying a current of electricity, instead of the present system of cumbersome and expensive shafts and pulleys.

It has been known then for at least seventeen years, and undoubtedly a great deal longer, that transmitting power by means of belts and shafting was expensive and uneconomical, and a remedy was pointed out at that time which is just being recognized to-day as good practice, and yet it is safe to say that nine-tenths of our mills and factories are still wasting enormous amounts of money by clinging to this antiquated practice of belt transmission. This is what is meant by the assertion that an enormous demand is in store for the electric motor.

We now see motors not only fast displacing belts and shafting, but also operating many kinds of machine tools, traveling cranes, hoists and elevators, pumps, ventilating fans, printing-presses, mining machinery, dredges, street cars, railways, vessels, air ships, implements of war, telescopes and scientific apparatus, and in fact almost every conceivable application of power.

Now there is one peculiar feature which comes up with each and every motor that is installed, namely, that a connecting link between the motor and what it is to drive must be provided which shall be adapted to the peculiar kind of work to be performed. This connecting link is the rheostat or controller, and the rapidly growing demand for these devices has given rise to what could almost be called the profession of rheostat engineering. By means of the rheostat or controller the motor is started and stopped, its direction of rotation is determined upon and the speed at which it shall rotate is varied at will.

The same motor which drives a pump would drive a fan, a printing-press or a line of shafting as well, but the proper type of rheostat to use for these various applications of power would be vastly different in each case. Generally speaking, there are but three kinds of direct-current motors, the series, shunt and compound wound, and the best suited of these three types of motors is selected to do the work. The types of rheostats for controlling these motors, however, are so numerous that only a few can be mentioned in this paper.

By far the largest number of stationary motors in use to-day are direct-current, plain shunt-wound, non-reversing and run at a constant speed. These motors are usually provided with motor-starting rheostats, whose resistance is in circuit only during the few seconds consumed in starting the motor. Simple as these rheostats are, great care should be taken in selecting the size and style best suited for the work.

A motor that is started and stopped but two or three times a day can be satisfactorily handled with a starting rheostat that would frequently be almost useless for starting and stopping a motor two or three times a minute. A rheostat arranged to start a motor under full load to the best advantage will not start a motor equally as well at 100 per cent. overload. A rheostat satisfactory to the fire underwriters of Chicago is not necessarily adaptable to the New York authorities, and would be looked upon as unnecessary extravagance by the country trade. It is important, then even in the very simplest cases, that the character of the work should influence the selection of the proper starter or rheostat, and when it comes to applying a motor to almost any other use than that of driving belts and shafting, the question becomes of still greater importance. Most stationary motors are operated at constant speed by consumers of power, and finding out that the speed of a motor can easily be regulated at will, and are calling for appliances which will accomplish this.

I can almost say that there is but one way by which the speed of a motor, of direct current, can be changed, and that is by changing the voltage across some of its parts or windings. There are a great many ways to accomplish this. The simplest, but unfortunately the most unsatisfactory way of reducing the speed of the motor, is to reduce the voltage across the armature by inserting external resistance in series with it. This method is uneconomical on account of the current absorbed by the rheostat, and also destroys the self-regulating property of the motor. The speed of a shunt-wound motor varies approximately with the voltage across the armature or brushes; with external resistance in series with the armature, the speed will vary to a much greater extent for the following reasons: When the load on the motor is increased the current C must increase. This increase of current can only occur by a decrease in speed which lowers the counter electromotive force of the armature, thereby permitting more current to flow. But the current, of course, has also increased in the rheostat, while the resistance R of the rheostat has, unlike the armature resistance, remained the same; hence since $C = \frac{E}{R}$ we see that the electromotive force E across the rheostat must be increased in some way, in order to allow more current to flow. This increase can be derived only by slowing down the armature and reducing its counter electromotive force. A very slight increase in the load when external resistance is in series with the armature will then often actually stop the motor entirely. Such cases as this have been so frequently causes of complaint from customers, that it would appear that the effect of external resistance in series with the armature is not at all well understood by either users, owners or salesmen of electric motors in general. The prevailing opinion seems to be that a speed regulator of the type mentioned can be set so that the motor will run at a certain speed, independent of the load. In proof of this assertion, many orders can be shown from some of the largest manufacturers of motors in the country, calling for a certain number of steps in the regulator to give a corresponding number of fixed speeds for the motor.

One method of changing the voltage across the armature is to operate the motor on a three-wire system, connecting the armature across the outside wires for high speed and between the neutral and one of the outside wires for low speed. This method wastes no current and causes the motor to assume a definite speed independent of the load.

Another method, which is ideal so far as the motor regulation is concerned, is to connect the armature across a variable number of storage batteries, thus obtaining any desirable speed over wide ranges. Still another method consists in so winding the armature that the coils may be changed form parallel to series, which can be accomplished in several ways.

Altering the voltage across the field of a motor also affects its speed, but in exactly the opposite way from that caused by changing the voltage across the armature. To increase the speed of a motor we can decrease the strength of its field, and there are many ways of doing this. The simplest and one of the best is the insertion of external resistance into the shunt-field circuit. This method is not only very simple and inexpensive, but, unlike the armature regulation through resistance, it wastes comparatively nothing in heat and allows the motor to assume the desired speed and maintain that speed independent of the load.

Motors are to be had of nearly all of the large builders which will operate satisfactorily with a field variation of 50 per cent. in actual ampere-turns. The same result is frequently obtained by using a compound-wound motor, winding the series fields in separate sections and cutting out these sections one by one by means of a special switch. At least one manufacturer goes so far as to use so many of these field sections that their resistance is sufficient to prevent more than the proper amount of current from flowing on closing the circuit without using any external resistance whatever. The series windings are then cut out one by one as the armature revolves. A very powerful starting torque and a

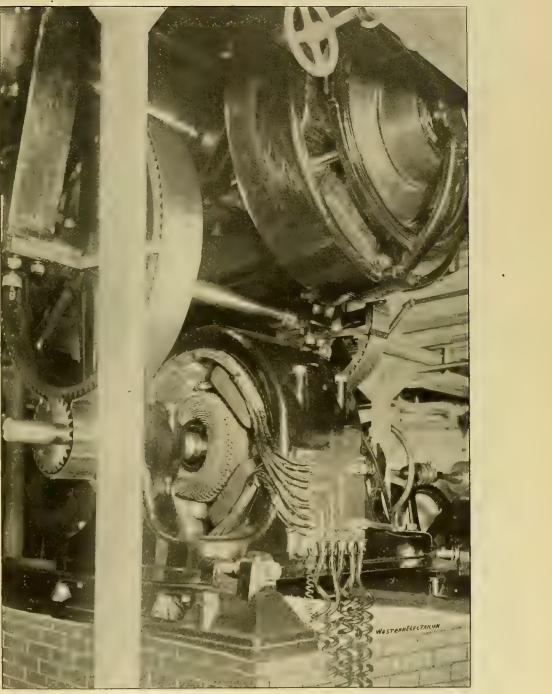


FIG. 3. A MODERN PRESSROOM.—MOTORS DRIVING PERFECTING PRESS.

1. Read before the Chicago Electrical Association, April 1, 1898.

wide range of speed is thus obtained. This method, however, will not regulate the speed independent of the load, as the field strength cannot be kept constant. It is applicable, therefore, chiefly to cases where an attendant is constantly on hand, as in the case of elevators, cranes and hoists.

One more method of varying the field strength consists in throwing the windings of the field cores into series connection for high speed and series multiple for slow speed.

Motors are sometimes regulated by means of using a separate generator for each motor, and varying the voltage of the generator by means of its field rheostat. This method is known as the Leonard system and gives perfect regulation over a wide range.

We have now before us a long list of methods from which to choose the system of regulation best adapted for the work at hand. One of the simplest and best is that frequently used for regulating motors driving fans and blowers, by means of so-called compound speed regulators. No large office or school building is now considered up to date which is not provided with artificial ventilation which can be regulated at will.

The motors which drive the fans are so belted or geared to the fan that when the fan is operating at the average speed desired no external resistance of any kind is in circuit. To reduce the speed the rheostat lever is moved to the left and resistance is cut into the armature circuit, and to increase the speed the lever is moved to the right and external resistance cut into the shunt-field circuit.

To select the proper sized motor and to determine upon the proper speed to run the fan requires an accurate knowledge of and experience with fans, air ducts and the laws of moving air. This is another subject which has not been reduced to a science by fan builders. Some builders always use a series-wound motor for driving fans and others have adopted the shunt-wound motor. When it is not necessary to vary the speed of a fan the series motor is probably preferable as being simpler, but for driving large fans, where speed regulation is always desirable, the use of a plain shunt-wound motor and a compound-wound regulator appears to be the best practice.

In proportioning the resistance for a fan-regulating rheostat it must be borne in mind that the power required varies directly as the third power of the speed, and not directly as the speed, as in driving shafting and machine tools. A regulating rheostat for a fan is therefore designed on entirely different lines, even the contacts and mechanism are different, because a fan is never started and stopped at frequent intervals during the day, and a cheap button front will do the work satisfactorily.

Diametrically opposed to the fan regulator is the electric elevator controller. This work calls for continually starting and stopping several times a minute all day long; heavy renewable contacts are absolutely necessary, as well as a special type of motor, and problems of entirely different character are to be met with. It is not practicable to build an elevator controller all ready to fasten to the wall with a string hitched to it for the operator to pull. Such devices are on the market in abundance, but should be regarded as a source of great danger.

An elevator controller, to be safe, should be embodied into and form a distinct part of the elevator mechanism, and should be attached to the elevator mechanism by the elevator manufacturer and not by the motor manufacturers or their selling agents.

There are a great many good methods of operating electrical elevators on the market. Among these methods in most common use is the system which uses a compound-wound motor and compound regulation. The motor is started through external resistance, which can consist of a rheostat or the windings of the series coils themselves. This resistance is then cut out in several steps under control of some kind of a governor; the series field coils are then cut out and finally the shunt field is weakened by the insertion of external resistance. The operation of electric elevators brings up the problem of how to reverse an electric motor. To accomplish this it is only necessary to change the relative direction of the current in either field or armature circuits. The moment we do this, however, new troubles arise; means must be provided to prevent the possibility of reversing the direction of the current without either first stopping the motor or at least inserting external resistance into the armature circuit. Means must also be provided to prevent excessive sparking or burning at the switches, as well as undue strain on the insulation of the motor.

In order to reverse a motor the field and armature have to be controlled by independent circuits. Whenever a circuit is suddenly opened that contains coils of wire wrapped around a mass of iron, a secondary or induced current is formed, which has a potential many times higher than that of the primary current. This current not only burns the switches, but is sure to injure the insulation of the motor sooner or later, unless means are taken to prevent it. Many designs of elevator controllers and rheostats on the market try to overcome sparking by opening the circuit with a snap switch, but electricity cannot be fooled in any such a simple mechanical manner as this. The flash and consequent strain on the insulation of the motor is only increased the more, and all that is gained is that the switch does not burn up quickly. This is no dream, but it is an actual fact that the market is flooded with rat-trap devices, which claim to eliminate sparking by means of snap switches. A snap switch is well enough for use in a lighting circuit, but when used in connection with a reversible motor it is a constant menace to the safety of its insulation. Everyone knows who has handled a motor that if the double-pole knife switch is pulled, even when the motor is heavily loaded, a destructive spark is never obtained. The reason for this is that the armature and shunt fields are not separated and consequently no induced current is formed in either and no strain whatever on the insulation occurs. The motor becomes a generator, energizing its own field, and gradually slows down and loses its magnetism. A similar condition of affairs can be obtained on a reversible motor. Before opening either the field or armature circuits both sides of the line should be opened simultaneously, which, of course, will cause no sparking, as just pointed out. External resistance should then be inserted into the armature circuit, and finally the armature connections should be reversed, leaving the shunt-field circuit at all times closed upon the armature. No destructive sparking or strain upon the insulation of the motor will then occur; the supply of current is absolutely cut off from the motor, and the short-circuiting of the armature through the resistance of the rheostat, occurring while the field is at full strength, acts as a dynamic brake and assists to stop the motor. This method of braking a motor is easily worked out, so that the ordinary mechanical brake never sets until the motor has stopped, or nearly so.

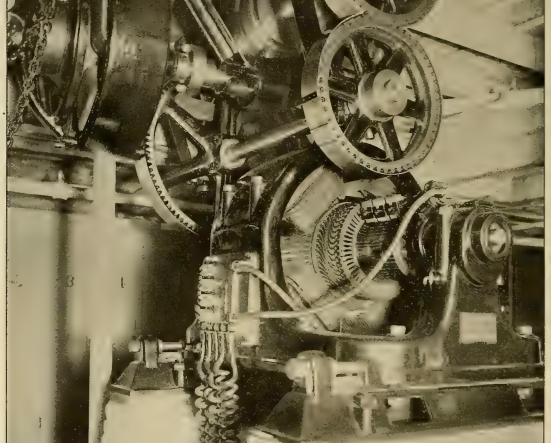


FIG. 4. A MODERN PRESSROOM.—MOTORS DRIVING PERFECTING PRESS (VIEW FROM COMMUTATOR SIDE OF LARGE MOTOR).

When an elevator is coming down with a heavy load the motor has no work to do and consequently has a tendency to run away, being driven by the weight of the elevator. If the motor is plain shunt wound and its field kept at constant strength, the load on the elevator will tend to drive the motor so much above its normal speed that it becomes a generator and returns current to the line. The speed of the motor will then increase until a potential is reached sufficiently above that of the line to consume the power derived from the effective weight of the elevator. The motor will continue to revolve at this speed, which in case of the plain shunt-wound motor would not be a dangerous speed. But plain shunt motors are now seldom used for elevators; almost all builders of elevators use compound-wound motors, or at least shunt motors whose field is weakened after starting.

Motors which bring an elevator to full speed by weakening the field would run much faster when driven by a heavy load on the elevator, and it becomes necessary for the attendant to check the speed by moving the lever back and thus strengthening the field. Should the attendant move the lever so far back that external resistance is inserted into the armature circuit, the speed of the elevator would be increased instead of decreased, as at first might be supposed, and a dangerous speed would result. This curious condition of affairs is due to the fact that with external resistance in the circuit with the armature when the motor is running as a generator, it will have to run enough faster to produce sufficient potential at the brushes to overcome the external resistance and deliver to the line the increased potential necessary to check the speed of the motor.

The application of the electric motor to the printing-press is another problem full of interesting points, which time will not permit of taking up, and we will pass on to the second part of the subject, the protection of a motor.

Motors burn out when overloaded, because they get hot. They frequently burn out also because currents of high potential are allowed to occur, which puncture their insulation. Excessive currents scar the commutators, and foreign material produces circuits which lead to damage.

To properly protect a motor from damage by the electric current, these four effects must certainly be guarded against.

Motors can only become dangerously hot by abnormal currents being allowed to flow for an appreciable length of time. A current of double or treble that of the continuous safe-carrying capacity of the motor will not do the slightest harm, unless allowed to flow long enough to overheat the motor. When such abnormal currents last only a few seconds it is neither necessary nor desirable for the protecting device to operate, and a properly designed protector should not operate unless the temporary abnormal currents exceed this amount, or last long enough to overheat the motor. Since it is the heating effect of the current which causes an overloaded motor to burn out, the most natural protection would be a device that operates through the influence of this same heating effect of the current. The well-known fuse was therefore recommended for this work and the electrical trade accepted it without question. As motors came into more general use it began slowly to dawn upon electrical engineers that they were being misled in their implicit faith in the fusible cut-outs offered by the trade. Too many motors supposed to be pro-

tected by fuses burn out, and experiments show that the ordinary commercial fuse will blow at almost any amount of current or not at all, just as it happens to feel at the time.

The manufacturers then attempted to more thoroughly standardize their fuses, and even made a faint attempt to standardize the cut-outs for holding them.

College professors took up the subject and made careful tests and wrote able articles about standardizing fuses. The conclusion which came was that the chief trouble lay in the fact that the fuses in common use were so short that the terminals and blocks to which they were fastened caused their blowing point to vary, by conducting off heat which would otherwise have caused the fuse to blow. This they said could be entirely overcome by using fuses six or eight inches long, and then we would have reliable fuses. Not enough significance appears to have been given to the cooling effect of the ever-varying drafts of air to which the ordinary commercial fuse is exposed, and therefore to expect any exposed fuse, no matter how long, to blow at a certain predetermined amount of current appears to the writer to be little short of an absurdity. People naturally became disgusted and looked around for something better with which to protect their motors. Into this breach the magnetic circuit breaker bobbed up serenely with its claim for perfection.

The magnetic circuit breaker recognizes nothing but amperes, and takes no account of whether the motor is hot or cold. Now amperes do not of themselves burn out our motors; it is the heating effect of these amperes, caused entirely by the length of time which they are allowed to flow. Volts, on the contrary, care nothing about time, so to speak; when the voltage gets high enough the current jumps, and the damage is done instantly, not through ordinary heat, but by the irresistible heat of the electric arc, which volatilizes the wires themselves. It should be noticed, howver, that excessive abnormal currents cause instant damage to the commutator of a motor, if not to the armature itself, and should be cut down as quickly as possible. This latter office the ordinary commercial circuit breaker will generally perform satisfactorily. It becomes a nuisance, however, by opening the circuit and interrupting the service at every little temporary abnormal fluctuation of current, which current would not do the slightest harm and calls for no protection. What is needed then for properly protecting a motor is, first, a device that will not allow extremely abnormal currents to flow into the motor at all; second, one that will alow slightly abnormal currents to flow through the motor, until the motor begins to approach a dangerous temperature, and, third, the device should check an excessive flow of current so that no undue strain will be put upon the insulation of the motor. No such ideal protection exists today, to my knowledge.

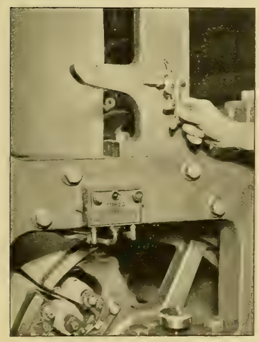


FIG. 5. A MODERN PRESSROOM.—CONTROLLING VALVES ON FRAME OF PERFECTING PRESS FOR LARGE AND SMALL DRIVING MOTORS.

The first requirement would be very difficult to meet, and the best that has been done so far is to stop the excessive flow of cuirent through the motor as quickly as possible. The other two requirements are more easily complied with. To protect a motor from heat it is evident that the heating effect of the current should be utilized in the protective device. This is accomplished in at least two devices, now on the market, namely, the inclosed fuse and a peculiar make of circuit breaker designed by the writer. [Both of these devices were shown by samples on the table.] The inclosed fuse is of the D. & W. make, and the fiber case has been removed in order to show its construction more clearly. The distinguishing feature of this fuse is the inclosed air chamber around the fuse proper, consisting of a gelatine capsule similar to those used by apothecaries for filling with quinine and other medicines.

The fuse proper is very short and is contained entirely within the capsule; copper wire leads are connected to the fuse and lead out to the terminal caps through closely-packed sand or plaster-of-paris. The capsule provides a definite amount of air within which the explosion takes place, thus greatly increasing the accuracy of blowing at predetermined currents. The force of the explosion is taken up by the layers of sand on each end, and as there is no air and but little metal to feed the arc, it immediately goes out. These fuses are surprisingly accurate, and being absolutely sparkless would certainly appear to be an ideal protection both for the motor and as against fire. They are ahead of the times, however, and the vast majority of those who operate motors still cling to the old bare fuse, working in the open air, for the protection of their motors.

Circuit breakers are being introduced very rapidly, however, as a protection for motors, and I have one here which is constructed on a somewhat different principle from anything on the market.

The action of this circuit breaker depends upon the combined magnetic and heating effect of the current. Its mechanical construction is very similar to the usual type, the chief difference being that the magnet or solenoid used to release the trip or catch carries only a portion of the current passing through the breaker. The rest of the current is shunted around the active coil of the circuit breaker, just as Edward Weston does in his well-known station ammeters. The shunt used in this circuit breaker, however, is composed of material whose resistance increases very rapidly as it becomes heated. The action of this circuit breaker is very simple. On starting up a motor under load, both motor and circuit breaker are cold; the resistance therefore of the shunt on the circuit breaker is at its lowest point and it carries then the largest part of the current flowing through the breaker; as this current continues to flow the shunt heats up, its resistance increases and more current passes through the magnet or active coil, which will finally act, should the abnormal current last long enough to become dangerous. It is also evident that an extremely abnormal current or a short-circuit would not wait for the heating effect of the current, but would cause the breaker to open instantly.

In practice these breakers are generally so proportioned as to allow a current of 50 per cent. greater to flow for a second, then would finally open the circuit, if allowed to flow for a minute or two. Any current over 60 per cent. greater than the continuous current which would finally open the circuit breaker will do so instantly.

A modification of the circuit breaker is the so-called overload attachment to motor-starting boxes, provided with the magnetic release. They are frequently spoken of as an under and overload motor starter. All the various makes of this type of motor starter use an electro-magnet for retaining a switch or rheostat lever in closed-circuit position. This retaining magnet is wound so as to connect in series with the shunt field, in series with the armature, across the lines or in series with external resistance across the lines. The overload magnet is invariably connected in series with the armature and carries usually the entire current supplied by the motor. When the current becomes excessive it attracts its armature and demagnetizes the retaining magnet by short-circuiting or opening the circuit of the windings of the retaining magnet. There are also several other ways of demagnetizing the retaining magnet.

A surprising degree of accuracy and reliability can be obtained in this way of protecting a motor from overloads. The system has, however, one chronic fault, which appears to have been entirely overlooked, and that is that no device constructed on the principle employed can possibly act quickly enough to protect a motor against extremely abnormal currents, short-circuits or lightning, notwithstanding all circulars and advertisements to the contrary. It takes time to demagnetize a magnet, no matter whether it is short-circuited or open-circuited, and this time is fatal on short-circuits and the motor will not be protected. We must then choose some combination of the various methods just described of protecting a motor. We have here on the table such a combination, which would appear to afford adequate protection for the least money. This device utilizes enclosed non-arcing fuses, the magnetic release, overload magnet and double-pole knife switch. The magnetic release affords ample protection from liability to damage from interrupted current. The overload magnet takes care of all ordinary overloads, and also performs the office of an ammeter which will indicate the approximate load on the motor at any time. The fuses are selected so as to blow on 100 per cent. overloads up to short-circuits. The overload magnet can also be provided with the time limit device, described above in connection with circuit breakers. This method of protecting a motor is laid before you for your consideration, and I desire to place myself on record as believing that with such a device on the market for protecting a stationary motor, there are very few places or conditions where the ordinary magnetic circuit breaker will afford equal protection and satisfaction, or be provided at as small a first cost.

Patent Office Improvements.

[Special correspondence of the Western Electrician.]

Washington, April 12.—Inventors will be interested to learn that the Platt bill, for revising and perfecting the classification of letters patent and printed publications in the Patent Office, has been reported favorably from the Senate committee on patents and that in all probability it will speedily become a law.

The patent system of the United States is based upon the theory that when an application for a patent is made it is to be determined whether the invention is new and useful and has been made by the applicant. This involves the examination of every application for a patent and search in the whole field of domestic and foreign patents already granted, and in all published technical works to discover whether the invention has been anticipated; in other words, whether, in the language of the constitution, it is "new and useful." The wonderful increase of inventions, at home and abroad, has greatly enlarged the field of search, and yet, if a patent is to be of real value to the inventor, and prima facie evidence of title to his invention, the search and examination must be thorough and complete. In order that this may be so it is absolutely necessary that the Patent Office shall contain all the documents and papers necessary for a complete investigation and that they shall be so classified that the examiners may in the shortest practicable time find everything relating to the subject-matter contained in the application for the patent. The better

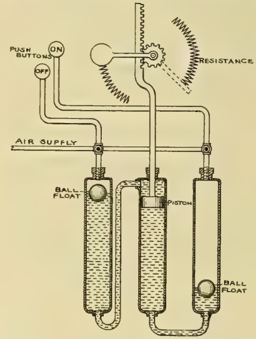


FIG. 6. A MODERN PRESSROOM.—DIAGRAM OF PNEUMATIC ATTACHMENT ON RHEOSTAT FOR LARGE DRIVING MOTOR.

the classification the more promptly the work can be accomplished, and the more certainty that a patent will not be granted for something old or known in the arts.

The increase in the field of search will be better appreciated when it is understood that each year since 1883 more than 20,000 patents have been issued by the United States. Last year the number was 23,794. The number of foreign patents issued each year is something over 60,000. The number of American patents, including designs, not including reissues or the registration of trademarks, labels and prints, issued up to January 1, 1898, exceeds 600,000. The number of foreign patents is over 1,122,000.

The pressing need now is for a more perfect arrangement of the patents and applications and references of all kinds in the Patent Office. When it is remembered that the expenses of the Patent Office are not only paid by inventors, but that a surplus is each year turned into the treasury of the United States, it would seem there could be no question of the duty of Congress to provide sufficient force for the prompt transaction of the business.

Maritime Electrical Association.

A movement is on foot at Halifax, Nova Scotia, to form a Maritime Electrical association. It is not intended to conflict with established organizations, as the preliminary circular announces that "while it is felt that all those engaged in the electrical business in Canada should, if possible, belong to the Canadian Electrical association, there still remains a great need for an association of a more local character, whose place of meeting would be accessible to all its members, and which could discuss not only papers of a technical character, but also the questions arising from purely local circumstances." Among the promoters of the project are mentioned the following named gentlemen: E. T. Freeman of the General Electric company, Halifax; James Waddell, Prince Edward Island Electric company, Charlottetown, P. E. I.; F. A. Bowman, New Glasgow Electric company, and J. H. Winfield, Nova Scotia Telephone company, New Glasgow, N. S

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Litigation over trolley patents is becoming involved and complicated and there is evident confusion in the public mind over the present status of the Van Depoele patents. The bearing of the last decision upon this case cannot be determined until the complete record of the court is obtainable. So many conflicting statements have been made by those interested in the outcome of the controversy that an opinion upon the merits of the case would be based largely, if not entirely, upon conjecture.

The American Engineer wants to know why it is that, with all the technical schools preparing young engineers, one of the leading trunk railroads and a large car manufacturing concern have difficulty in securing satisfactory draughtsmen. Possibly the answer lies in the very fact that nearly all of our American schools undertake to turn out engineers exclusively and not draughtsmen. American students look upon mechanical drawing as a means to an end only, and very few of them are content to accept it as a life work. They are ambitious to do original work as soon as possible after graduation and often begrudge the longer or shorter time in which they are engaged as draughtsmen or assistants to older engineers. It is a fact that in this restless ambition and struggle for the prizes of the engineering profession many a man who might have been a first-class draughtsman all his life ekes out a precarious existence as a third-rate engineer. But the tendency is due to a deep-seated characteristic of American life—the keen ardor of meeting and solving the material problems of a continent—a trait which undeniably makes for progress.

Many cities now require street-railway companies to provide their cars with fenders or guards, but many corporations object on the ground that these so-called protective devices cause more accidents and inflict more injury than they prevent. It is contended that since the general adoption of electricity as the motive power for street railways the limit of speed attained has been raised considerably, and that this change has been accompanied by a corresponding increase in the number of accidents. It may be maintained that by far the greater part of these accidents are due directly to the carelessness of the victims and that a large percentage of the rest result from incompetency or carelessness on the part of the motorman, but occasionally there is an unavoidable mishap in which someone is injured, and then a cry is raised against the "deadly trolley" and urgent demand is made for fenders. Considerable litigation growing out of accidents of this description has occupied the higher courts in several states and several important points have been decided. According to late rulings it matters little whether the accidents are due to the carelessness and incompetency of employes or to defective and inadequate apparatus and protective devices.

In the case of Chandler against the Atlantic Coast Electric Railway company it was shown that an employe was engaged in the work of clearing away the dirt and refuse which had collected upon the company's track, and while so engaged was run down and killed by one of its cars. Negligence was charged against the company, in that it had failed to provide suitable fenders or guards for its cars, but the Supreme Court of New Jersey held that, even if it be conceded that such omission made the cars more dangerous to employes working upon the tracks than otherwise they would have been, no liability can be predicated upon such negligence. The court declares that it has been settled in this country and in England that if a servant chooses to enter employment involving danger of personal injury, which the master might have avoided, he takes upon himself the risk of all the hazards incident to the employment, the existence of which is known to him, or which are plain and obvious, and which he has no reason to expect will be counteracted or removed, and that no action will lie against the master for injuries to the servant resulting from such dangers. On the other hand, the contention was raised that the company was also negligent in knowingly employing an unskillful and incompetent motorman to operate the car which ran down the decedent. The Supreme Court pronounces this a good cause of action, as a master owes to his servants the duty of using reasonable care and prudence in the selection of their fellow servants, and, if he knowingly employs or retains in his service an unskillful or incompetent workman, he is responsible for injuries received by an employe through the unskillfulness or incompetency of such workman.

On the trial of an action by a traveler on a public street for injuries caused by the alleged negligence of a motorman employed by the defendant, the St. Paul City Railway company, evidence of the general incompetency of the motorman was allowed to be introduced, but the Supreme Court of Minnesota holds that this was error and that such evidence is inadmissible in such a case. The court declares that the company is liable, if at all, for the acts of its servant upon the doctrine that the principal or master must answer, or is responsible, for the acts of his agent or servant. If the motorman was negligent on this occasion, the company was liable, no matter how competent he was or how habitually careful he had been on other occasions. On the other hand, if he was not negligent on this occasion, the company was not liable, notwithstanding that he may have been incompetent or habitually careless on former occasions. If the complainant could offer testimony as to the general incompetency or prior negligent acts or omissions of the motorman, then, with equal propriety, the defendant, upon the issue of contributory negligence, might present evidence of the complainant's general carelessness, or of his negligent acts on other occasions. Likewise, private rules of the company, intended only for the guidance of its employes, and not known to the complainant, the Supreme Court holds, were inadmissible, in determining the company's liability. Finally, the company having omitted to call its motorman as a witness, although within reach and available, the Supreme Court holds that the trial court was, under the circumstances, justified in instructing the jury that, in weighing the effect of the evidence actually introduced, they were at liberty to presume that the testimony of the motorman, if introduced, would not have been favorable to the cause of the company.

In England the fever for municipal control of quasi-public enterprises has developed to an alarming degree. In one place an advantageous offer to establish a first-class telephone-exchange service at a cost of $200,000 was rejected and the city determined to put in its own plant. The only explanation offered is the statement that public opinion is favorable to municipal control of such enterprises.

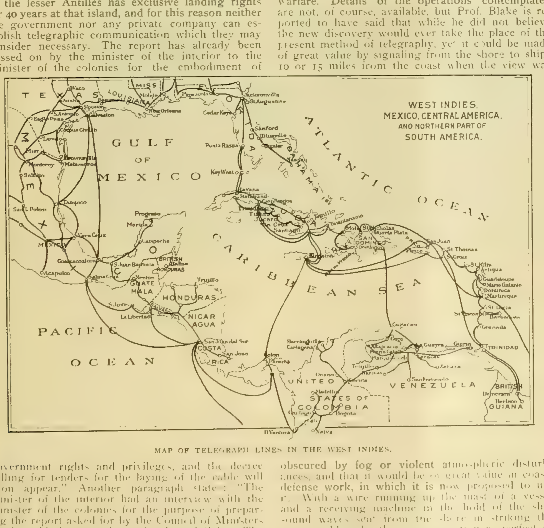
The restrictions placed upon the National Telephone company by the municipal government of London amount practically to supervision of the work of that company by the city. This tendency, it is claimed, has greatly retarded the growth of the business, and the recent check placed upon the city has been a source of congratulation on the part of the company. It would seem that it was not received with good grace by the municipality, however, for, according to the London electrical press, the corporation of London is still fretful about the recent decision that the postmaster-general may lay what telegraph or telephone wires he pleases in the streets of London, and may lease them to the National Telephone company or anyone else. The corporation has endeavored to raise a kindred feeling of resentment in the breasts of other local authorities. The resolution proposed at the annual meeting of the Association of Municipal Corporations declaring that "it is undesirable that the jurisdiction of the local authorities over telephone companies should be curtailed or interfered with" shows exactly what the grievance is, for no one can impartially argue that to give local authorities the right to veto the use of underground junction lines, as a connection between telephone subscribers and the trunk lines, can tend to improve or cheapen the telephone service. The use made by the corporations of their right of positive veto is said to be retarding the burying of the wires and the consequent improvement of the telephone service. But the city solicitor and his supporters say that they do not wish to have their privileges curtailed by the National Telephone company through the postmaster-general; that they do not want to be overridden by any of the telephone companies, and that the companies overran the roofs of houses as if they were their own private property.

The treatment accorded the telephone interests of this country is in striking contrast to the picture presented by our English contemporaries.

WAR NEWS.

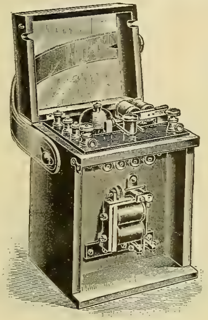
West Indian Cables.—In the present crisis in the affairs of the United States and Spain the accompanying map of the telegraphic cables and principal land lines in the West Indies, Florida, Mexico, Central America and the northern part of South America will be of interest. The direct communication between Cuba and the United States is by a duplicate Western Union cable laid from Havana to Key West and thence to Punta Rassa, on the west coast of Florida. This affords one means of communication, also, between Cuba and Europe by connecting with the numerous cables crossing the North Atlantic. However, if this route was closed to Spain, as it would undoubtedly be in wartime, there would still remain, as shown by the map, several means of connecting with the mainland of South America, and thus, by way of Pernambuco and the South Atlantic cables to Lisbon or Cadiz, reaching Spain. The Cape Verde Islands, where the Spanish torpedo flotilla is now said to be, form a station in the Lisbon-Pernambuco cable. Of course, in case of war, our government might undertake to cut the Caribbean cables, to isolate Cuba, but this would raise the vexed question of the neutrality of submarine cables, which does not appear to be well settled by international law. The existing commercial rate to Havana is 40 cents a word; but the press rate, which is practically the only one used, is five cents a word to that city. To stations in Cuba beyond Havana and to other West Indian stations, messages are sent either by way of Havana or by way of Galveston, the latter city being an important connecting point in the network, as shown by the map.

If Spain is allowed to keep Cuba, which seems unlikely, it will undoubtedly want more direct communication than the roundabout routes by the United States or South America. As already noticed in the Western Electrician, the direct-cable project has taken a definite form, but for several reasons it will probably never materialize. An interesting insight into the views of the Spanish themselves is given by the following from recent issues of El Imparcial of Madrid: "The Ministry of the Interior has reported favorably on the tender for the laying of a direct cable between the peninsula and the island of Cuba. The cable will land at Cadiz, Santa Cruz de Tenerife, Nieques (an island situated 15 kilometers to the east of Porto Rico), and finally at Havana. The cable will not, contrary to the interest of the nation, be laid to St. John, Porto Rico, as the company owning and working the cables in the lesser Antilles has exclusive landing rights for 40 years at that island, and for this reason neither the government nor any private company can establish telegraphic communication which they may consider necessary. The report has already been passed on by the minister of the interior to the minister of the colonies for the embodiment of government rights and privileges, and the decree calling for tenders for the laying of the cable will soon appear." Another paragraph states: "The minister of the interior had an interview with the minister of the colonies for the purpose of preparing the report asked for by the Council of Ministers on the cable between the peninsula and Cuba. The report will deal with two proposals, one being for the construction of the direct cable, and the other for a branch cable from Havana to Haiti, to connect there with the French system." Another issue of the same paper says: "The news that the ministers of the colonies and the interior have been entrusted by their colleagues in the council with the decision regarding the matter of the direct cable to Cuba, and, further, that there are two proposals to be dealt with, viz., (1) offering to construct a direct cable, and (2) a branch cable from Havana to Haiti, there to be connected to the French system, has given rise to certain fears, which we find to have serious foundations, as by the latter scheme we should merely be ridding ourselves of the control of our communications by Great Britain and the United States to transfer it to the French. The Nacional states if the direct cable is not to be laid, rather than allow all the traffic to be handed to the French Cable company, let the state of affairs remain as at present. Our contemporary asks for more light upon the subject from the ministerial press, and we join in the demand, as we endorse their opinion."



MAP OF TELEGRAPH LINES IN THE WEST INDIES.

Wireless Telegraphy.—It is possible that one of the innovations of the war, if war there be, will be the use of a system of wireless telegraphy between warships or between ships and the shore. Commodore Schley is mentioned as an officer who is familiar with the naval tests of the new system, and who is said to favor it. Prof. L. I. Blake of Kansas University has also paid much attention to the practical possiblities of wireless telegraphy in warfare. Details of the operations contemplated are not, of course, available, but Prof. Blake is reported to have said that while he did not believe the new discovery would ever take the place of the present method of telegraphy, yet it could be made of great value by signaling from the shore to ships 10 or 15 miles from the coast when the view was obscured by fog or violent atmospheric disturbances, and that it would be of great value in coast-defense work, in which it is now proposed to use it. With a wire running up the mast of a vessel and a receiving machine in the hold of the ship sound waves sent from the shore in striking the wire would make the communication as perfect as could be desired.



WIRELESS TELEGRAPHY. THE RECEIVER.

One type of receiver for telegraphic signals without wires is shown by the cut. It was displayed at a meeting of the Institution of Junior Engineers at London on March 12th by Leslie Miller, who gave an exhibition of telegraphing without wires from one end of the room to the other. He employed the simple receiver which is herewith illustrated. The coherer is suspended in the middle of a stretched wire, and two small rods, with a screw thread on them, play over the wire like a fiddle-bow over the strings. These rods are attached to the armature of a bell, connected in the secondary circuit of the relay (seen in the front of the case), whose primary circuit is in series with a single dry cell and the coherer. A second cell is used in the secondary circuit. This form of decoherer has the advantage that the decohering action begins directly the armature moves, and continues during its whole travel to and fro. The coherer itself merely consists of a small ebonite cup, inside which the two wires on which it is suspended almost meet, the gap being bridged over by nickel filings. During the experiments a simple transmitter was employed, consisting of a four-inch solid brass ball, with a one-inch brass ball on either side. The spark-gap was comparatively short. Signals were transmitted from one end of the room to the other, and the demonstration was pronounced successful in every particular. Among the prominent men in attendance was Hiram S. Maxim, who displayed great interest in the experiment.

The system has recently been successfully applied to permanently establish telegraphic communication for the British War Office between Lavernock Fort and the fort on the Flat Holm (in the Bristol Channel), a distance of 3¾ miles. On the mainland, opposite the island, an ordinary pole line, three-quarters of a mile long, with a heavy copper wire, has been erected; the ends of the circuit terminate in the sea. On the island there is a similar line established about half-a-mile long. The transmitting apparatus (on each line) consists of a contact breaker worked by a small dynamo, running at 3,000 revolutions per minute, and giving 250 makes and breaks per second, corresponding to the middle C note; the intermittent current is given by 10 dry cells. An ordinary Morse key interrupts the circuit, and the receiving apparatus is an ordinary telephone receiver. The installation has been carried out under the direction of Mr. Gavey, assistant engineer-in-chief to the Postoffice Department, assisted by Mr. Taylor. It has been found impracticable to maintain communication between the two forts by means of a cable, as the latter was continually broken by the anchors of the shipping.

Electrical Wiring in Harbors.—The work of electrically equipping all the forts in New York harbor is about completed, and the work in the other important harbors along the Atlantic Coast is also well advanced. Submarine cables and underground wires have been laid connecting all of the New York forts with headquarters and with each other, so that instant communication by both telephone and telegraph will be possible. A large amount of wire has been put in place for connections with submarine mines, and the dynamos have been placed for the searchlights at all the forts. The big 60-inch searchlight which was used on top of the Manufactures building at the World's Fair, and has since been at Sandy Hook, has been moved to Fort Monroe. But the dynamo and wires used with it are still at Sandy Hook, and a new projector will be put up there. There are many searchlights in different parts of the country which can be secured, and all that are needed will be speedily put in place. There is a searchlight in readiness at Fort Wadsworth, and the electrical equipment there is completed. About 60 miles of wire have recently been contracted for, and much of it is for submarine mine connections. A high quality of protected cable will be laid and the mines can be quickly put in place and connected therewith. A number of Battery boatmen have recently been hired to assist in this work, as it requires experience to handle a small boat on the rough water frequently found at the Narrows and in the ship channel off Sandy Hook.

A dispatch from Boston, dated April 8th, gave the news of the work at that point: The first steps in the actual work of completing the defense of Boston harbor by means of submarine mines were taken this morning, when a score of expert electricians left the city for Long Island Head, taking with them many coils of insulated wire cable and considerable electrical apparatus. Long Island, from which will be controlled the mines in Broad Sound, will be first arranged and then will come the work at Fort Warren for the mines in the main ship channel. The shore wires will be carried down to the water in the rear of the forts and the submarine cable led around to that point. With the shore connections and apparatus in place everything will be ready for action as soon as the engineer corps places its mines and lays its submarine cables. This work will not take over 48 hours, for the mines themselves have been ready for some time at Fort Independence, Cast Island, while all needed cable and connections are also at hand.

General Greely's arrival is reported from Savannah. In addition to the electrical work, the general is in charge of the new coast and gulf line signal system, by which communication will be established between ships near the coast and the Navy Department. An allotment of $20,000 for each state has been made from the emergency fund for erecting tall signal poles at the chief stations, the construction of the semaphore house stations for signal purposes, and other signal appliances.

From Philadelphia it is reported that the services of the Philadelphia Electrical Division, composed of practical electricians organized to serve the government if needed, have been accepted by Major Raymond, U. S. A. The electricians are on waiting orders to assist in laying submarine mines in Delaware Bay and other electrical work in connection with the defense of the city.

[*Continued on page 231.*]

DEVELOPMENT OF THE TELEPHONE FIELD.

Growth of Independent Movement in the South.

[Special correspondence of the Western Electrician.]

The opposition exchange started at Shreveport, La., three years ago has met with great success, the company now having 505 subscribers, while the Bell exchange has only a few subscribers.

The independent exchange installed at Monroe, La., two years ago continues to increase its business and now numbers 180 subscribers. The old company has retained very few subscribers and some of these have recently deserted it.

The People's Telephone company of Jackson, Miss., which came out in opposition to the Bell in August, 1896, began with 100 subscribers, against the old or Bell company's list of 144 subscribers, has steadily increased its list and now includes 340 instruments at Jackson and has connection with a large number of towns and villages within 40 miles of its exchange. The old company is rebuilding its line work and has under construction a new line to connect Jackson with Vicksburg, the old line to the latter point being almost useless.

The Yazoo City (Miss.) Mutual Telephone company, which began one year ago, has more than twice as many subscribers as the Great Southern (Bell) company ever had, and by the terms of the contract its subscribers agree to use no other service than the Mutual, so that it looks as if the Bell people will be forced out rather than the home company.

The Citizens' Telephone company of Crystal Springs, Miss., which has installed an independent exchange at Vicksburg, began its service September 1, 1897, and now has over 350 subscribers connected with its exchange, including every business firm in the city using a telephone, excepting one stable and one cotton broker. The Cumberland (Bell) company, finding that the new exchange was rapidly depleting its list of subscribers, is making an active canvass of the town, offering residence 'phones at $6 per year as against the former rate of $36 per year. The Citizens' exchange is connected with Yazoo City and intermediate points and will probably build a line to Jackson, Miss. The Citizens' company has just completed rebuilding its entire plant at Crystal Springs, Miss., and has moved into its new quarters, having erected a small building in the center of the business district for the accommodation of its business. Its list of subscribers has increased rapidly. By its long distance lines it is connected with a large number of towns and villages, including the more important points in the surrounding counties.

The Canadian and Cheyenne Telephone company of Canadian, Texas, has been formed, with a capital stock of $2,500, by George Gerlach, Robert Moody and D. J. Young.

At Snow Hill, Md., C. J. Purnell, W. S. Powell, W. F. Johnson, J. P. Moore and others have incorporated the Worcester Telephone company, with a capital stock of $2,500.

A charter has been granted the West Plains, Mo., Telephone company, with a capital stock of $25,000, by D. W. Reese, Charles H. Gale, F. O. Hines and others.

C. O. and H. J. Patton, Lewis Schultz & Co., William A. Patton, Jr., and others have incorporated the McFall (Mo.) Telephone company, with a capital stock of $1,000.

Automatic Telephone Service.

In several large cities where opposition to the Bell company has been manifested local capitalists have been attracted by the automatic telephone system that has been developed during the last 10 years. When first introduced it was crude and in some respects not well adapted to the general work required of exchanges, but experience has pointed out these defects, and as they have appeared they have been carefully studied and corrected.

Now, it is claimed, the Automatic Telephone Exchange company of Washington has its apparatus in practical operation in the following-named cities: Augusta, Ga, Aiken, S. C., Maryville, Kas., Morgantown, N. C., Albuquerque, N. M., Amsterdam, N. Y., Manchester, Ia., Trinidad, Colo., Rochester, Minn., Perry, N. Y., Princeton, N. J., Coudersport, Pa., Albert Lea, Minn., Albion, N. Y., La Porte, Ind., Chester, Ill.

The exchange at La Porte, which was the first of the kind in the world, was the subject of an illustrated article in the Western Electrician of November 12, 1892. The apparatus employed in the automatic system had been illustrated and described in detail in this journal on August 6th of the same year. By referring to these numbers and comparing them with the illustrations accompanying this article, some idea of the advancement that has been made will be gained. Fig. 1 shows the exchange equipment employed at Trinidad, Colo., the board having a capacity of 200 subscribers. A much larger equipment is represented in Fig. 2, which illustrates the apparatus employed at Augusta, Ga., with capacity for 1,000 subscribers.

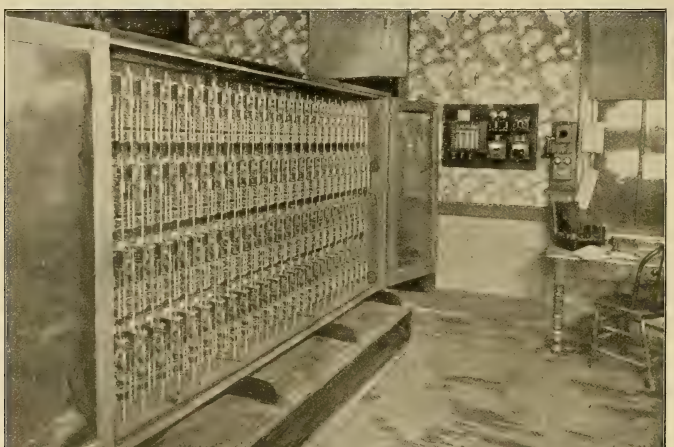


FIG. 1. AUTOMATIC TELEPHONE SERVICE.—EQUIPMENT OF EXCHANGE AT TRINIDAD, COLORADO.

It should be borne in mind that the "exchange," as the term is generally employed in telephony, is eliminated from the service in the automatic system. The latter connects each subscribers' telephone with an apparatus at a central point which possesses the functions of a complete switchboard. The apparatus bears no resemblance in form to a switchboard, but so concentrates in itself the terminals of the lines of other subscribers that the caller, by simply touching the figures designating the number wanted, connects the latter line with his own, ready for conversation in absolute secrecy, and, by hanging up the telephone after use, restores all parts to normal condition. Each subscriber's line terminates at the central station in a similar miniature switchboard or terminal apparatus, occupying but little space, all being connected and concentrated in a glass case where, free from dust or disturbance, it is claimed, they may remain for years, giving better and better service as the contacts wear to greater exactness of surface touch.

The system as developed is an interesting and attractive combination and has won commendation from many practical exponents of modern telephony.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Two tramp linemen stole about 175 pounds of copper wire from the Iowa Telephone company at Boone, Ia., and disposed of it at a junk shop. They were captured, tried and convicted, and sentenced to 15 days in jail.

C. G. Cockerill will build a telephone line from Jefferson, Ia., to Grand Junction at once. Mr. Cockerill has just bought the Jefferson Telephone company. He owns all the lines built by that company north and east of Jefferson.

F. G. Barrows is an applicant for a telephone exchange at Fergus Falls, Minn. The Minnesota Central Telephone company wants a long-distance franchise there.

John Gay has been appointed manager of the Northwestern Telephone Exchange company at Winona, Minn., succeeding Mr. Griffin, the present manager, who will be transferred to some other point.

An all-night telephone service will soon be established at Glenwood, Ia.

For some time past H. C. Van Hovenberg of Eau Claire, Wis., has been objecting to the Eau Claire Telephone company locating a telephone pole in front of his property. No arrangement could be made between them, and the company quietly set the pole at one o'clock in the morning. Work was finished long before anyone was astir. It is said legal measures will be taken to compel the removal of the pole.

The Western Telephone Construction company is an applicant at Stevens Point, Wis., for a long-distance connection.

The American Bell Telephone company has bought at Menominee, Mich., 20,000 telephone poles, costing $75,000. This is the largest deal in telephone poles ever made in that section.

The telephone service in Tacoma, Wash., has been materially improved by the new plant that has just been put in.

The Iowa Telephone company is seeking to increase its subscribers at Bedford, Ia. It will reduce rates when 30 new names are added.

T. F. Robinson of Tracy, Minn., is an applicant for a telephone franchise at Windom, Minn. Mr. Robinson is now putting in an exchange at St. James.

Forty instruments have been subscribed for in the local telephone exchange just organized at Glenwood, Minn. M. A. Woollan, P. Peterson and C. L. Peterson will form a company for the exchange.

The American Telephone and Telegraph company has connected with La Crosse, Wis., over the wires of the Wisconsin Telephone company and now gives La Crosse long-distance service.

The new telephone exchange for Marshfield, Wis., is to be rushed as fast as possible. The survey has been made.

The Rocky Mountain Bell Telephone company disregarded the temporary injunction secured by a

stockholder in the Electric City Telephone company at Great Falls, Mont., which it has just absorbed, on the ground that it was inoperative, being served after the sale had taken effect. At the hearing this view was upheld and the injunction dissolved. George H. Stanton, a stockholder, then brought suit, alleging that the independent company was in good shape when the deal was made and not losing money, but would have paid a fair dividend. He charged that the sale was illegal. A temporary injunction was issued to prevent the Bell company from discontinuing the service, and the matter will be argued in court.

The New Prague and Veseli Telephone company has been incorporated to build a telephone line in Minnesota between those places.

The Northwestern Telephone company and the Cedar Valley Telephone company will have a common office at Nashua, Ia.

The Rosendale, Ladoga, Rogersville and Eldorado Telephone company has been organized to connect those towns in Wisconsin.

C. E. Thew, Jr., who has been manager of the local telephone company in Menomonie, Wis., will go to Ashland, Wis., to work for a telephone company there.

The town of Fairbanks, Ia., will vote soon on granting a telephone franchise to J. E. Shannon.

A stock company will be formed to put in a telephone exchange at Mason City, Ia.

The Mississippi Valley Telephone company expects to spend $10,000 for labor in putting in its new exchange at Muscatine, Ia. Work is to be begun very soon.

A new telephone company will be formed in Stillwater, Minn., to put in a telephone exchange. The council is considering its application for a franchise.

A telephone line is to be built between Preston, Minn., and Prairie Queen, by D. R. Thatcher, William Fishbaugher and John Berning of Prairie Queen.

Municipal Telephone Exchange.

Rather than accept the offer of the National Telephone company of England to spend from £30,000 to £40,000 in reconstructing the Huddersfield telephone system and making it as perfect as present experience renders possible, the general purposes committee, consisting of the entire corporation of that city, has adopted the recommendation of the electric-lighting committee that the telephone system should be placed under municipal control. The sole inducement would appear to be that Huddersfield wishes to possess the first municipal telephone system. A contemporary which sympathizes with the idea says that local-government control of telephone system, however, must not be placed on the same footing as that of baths and washhouses, electric light and waterworks, or even street railways.

Cost of Telephone Litigation.

The Australian Building, Engineering and Mining Journal says: "Since 1880 the American Bell Telephone company has spent £469,685 in litigation. This expenditure to uphold patents which give an incomplete monopoly is large—but America is America."

Long-distance Telephony in Canada.

[From the Canadian Electrical News.]

The first attempt of the Bell Telephone company of Canada to establish a long-distance service was made in 1881 by the construction of a single iron-wire line between Toronto and Hamilton, then considered quite an achievement, and the line was well patronized. Within three years 855 miles of poles and 1,500 miles of wire were constructed by the company, but so rapidly did conditions change, that even in this short time this type of line was found inadequate to the requirements of a growing business.

In 1885 copper wire was substituted for iron wire, affording better results. The introduction of the electric light and trolley, however, soon forced upon the company another and a more radical change, and metallic circuits had to be adopted upon all principal lines. This change, begun in 1885, was carried on as fast as circumstances would allow until all the principal lines of the company were made metallic, or, in other words, two wires were necessary to transmit a satisfactory conversation where one would suffice before the introduction of electric cars.

The extension of the system, in the meantime, went on apace, until, at the end of 10 years, the company had in operation 4,484 miles of pole line and 13,148 miles of wire in its long-distance service, and at the present time they have in the provinces of Ontario and Quebec 6,095 miles of poles, bearing 16,567 miles of wire.

Connections have been established with the extensive long-distance system of the American Telegraph and Telephone company and affiliated companies in the United States at Newport, Vermont, St. Albans, Ogdensburg, Buffalo and Detroit, affording a system of direct telephonic communication as far south as Virginia and Tennessee, and from the cities and towns of the Atlantic seaboard westward to Nebraska.

The difference in the cost of the first long-distance line of 1881 and the long-distance line of to-day affords one of the serious problems in finance which the company has to meet. It is not a mere matter of change; it is a revolution requiring absolutely new and far more expensive construction. In 1881 a No. 9 iron wire (288 pounds to the mile) was the best in use. To-day most of the construction is of two copper wires (which together weigh 532 pounds to the mile). Formerly 32 poles to the mile were sufficient, but with the introduction of copper, in order to reduce the strain upon the wire, 40 poles to the mile are used. The poles have to be set deeper in the ground and more carefully stayed, all of which greatly increases the cost.

The long distance central office equipment of to-day is much more expensive than it was 10 years ago, improvements having been made to facilitate the work of operating and to secure the best results in communications. The astonishing results which the long-distance telephone service of to-day affords is due as much to the improvement in instruments, switches and other apparatus, and to the system upon which these are employed, as it is to the improvement in the lines.

Telephone Service in Germany.

In view of the growth of the German electric railway lines, and the extensive use of the single-wire system for the telephones in that country, it is remarkable that the railway and telephone interests have not come more into collision. An incident is reported from Elberfeld, says the London Electrician, where the telegraph administration has protested against the running of the Neviges-Velbert electric railway, as it disturbs the telephone traffic in the district, and it requests the company which owns the line to place the telephone lines between Elberfeld and Neviges (a distance of five miles) underground. It is certainly high time that the German telegraph administration decided to adopt metallic circuits, and to place them underground in the towns, for at present the service is far from perfect, and it is notably bad in the manufacturing district of Rhenish Prussia and Westphalia, at the center of which Elberfeld is situated. The telephone administration in Germany does not treat subscribers well in the matter of instruments. It has decided to supply subscribers with only one receiver instead of two. If the subscriber wishes to have a second receiver, he must buy it for 10 shillings from the administration, which will "keep it in order" for him for a consideration. It is true that one German instrument of the pattern used by the administration, weighing as it does 1½ pounds, is bigger than two English ones, but yet the rule appears hardly fair. If the subscriber wishes a bell different to that offered him he has to buy it, and a desk instrument, in place of the usual wall set, costs five shillings a year extra. If he objects to having the bell, battery box and transmitter on the same wall, he has to pay a supplementary charge for the use of his own second wall. The only redeeming feature, in fact, of the German telephone service is its very low subscription rate.

FIG. 2. AUTOMATIC TELEPHONE SERVICE.—1000 SUBSCRIBERS' EQUIPMENT AT AUGUSTA.

Kansas Enterprise.

Manhattan leads the world in one thing, and that is its telephone system. Stockholm, Sweden, has long been in the lead with a record of one telephone for every 20 people, but Manhattan has one for every 13 people. An average of 1,500 calls a day from the 235 telephones keeps Miss Mabel Crump busy, while a proportionate number of calls are answered by Miss Ada Howe during the night. In large cities one operator has charge of but 100 telephones, but Manhattan girls are smarter than the average, and they do the extra amount of work nicely.—Manhattan Mercury.

The Wareham & Wood Telephone company to-day put in a new 200-wire cable. There are now 125 'phones in use in the city and new subscribers are being added daily. The construction force is now within three miles of the city, and by the middle of the coming week Chanute will have telephone connection with Humboldt, Iola, La Harpe, Moran, Bronson, Uniontown, Redfield and Fort Scott. Chanute has every reason to be proud of its telephone system, and Wareham & Wood, the owners, are to be complimented upon their enterprise and hustling proclivities.—Chanute Tribune.

Telephone Competition for Philadelphia.

Another attempt will be made to establish a rival to the Bell company in Philadelphia. An ordinance was introduced in the Common Council of that city on Thursday, April 7th, by the terms of which the Drawbaugh Telephone and Telegraph company is authorized to lay conduits, erect poles and conduct a local telephone-exchange business. This company applied to councils for privileges in the spring of 1894, at which time two other telephone ordinances were under consideration, one of them being that of the Mutual Automatic Telephone company. All were referred to the electrical committee. The subsequent history of the Mutual company is familiar to telephone men.

The Drawbaugh company has persisted in its efforts to secure a franchise, and although its petition was not granted in 1894 nor in any of the subsequent councils, the promoters of the enterprise continue to press their claims with unabated vigor. The officers of the Drawbaugh Telephone and Telegraph company are: President, J. F. Stokes; treasurer, John D. Ford; secretary, Charles A. Gladding; general manager, Brinton N. Newcomb; directors, J. F. Stokes, Monroe Smith, John D. Ford, William O. Hempstead, Charles A. Gladding, Brinton N. Newcomb and Samuel L. Kent.

Holtzer-Cabot Telephone Receivers.

The new metal head receiver manufactured by the Holtzer-Cabot Electric company of Brookline, Mass., is shown by the accompanying cut (Fig. 1). The head or cup of this receiver is of metal, which is screwed on and firmly attached to the metal tip, which also carries the compound bar magnets; the rubber shell is simply slipped over these and held in place by a screw at the farther end. The adjustment between the tip and diaphragm, it will be seen, is permanent and cannot be affected by changes of temperature. This is claimed to be a more practical form of receiver than any of the adjustable-head styles on the market. Inexperienced men with more inquisitiveness than practical knowledge of telephonic conditions can, by "just altering the adjustment a trifle," throw them out of order or seriously impair their efficiency. This contingency is

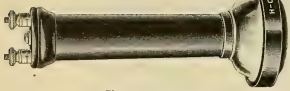


Fig. 1.

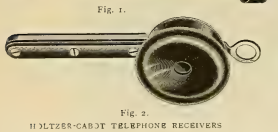


Fig. 2.
HOLTZER-CABOT TELEPHONE RECEIVERS

provided against in the construction of the Holtzer-Cabot metal head receiver by making the adjustment at once perfect and permanent.

The Holtzer-Cabot company also manufactures standard and pony receivers, using the best hard rubber shells of sufficient thickness to insure their not varying materially under changes of temperature. The company makes a strong point of the fact that by its method of construction it positively prevents dust from falling down and accumulating on the magnet tip. It also manufactures a bi-polar watch case receiver and a single-pole watch case receiver with handle (Fig. 2). The latter is claimed to be the most convenient form of receiver made. These styles are fully described in a new telephone catalogue which the Holtzer-Cabot Electric company has just issued.

COMMUNICATION.

The Firman Patent.

To the Editor of the Western Electrician:

Noting the communication of Barton & Brown in your issue of the 2d inst., entitled "Firman Switchboard Patent Sustained," I will say that the case referred to is one of two suits instituted against the Capital Telephone and Telegraph company by the Sunset Western Electric-Bell combination in October, 1895, or about the time we entered the telephone business in Sacramento.

The first, which was upon the use of the Watson automatic telephone switch upon our instruments, was dismissed at complainant's cost.

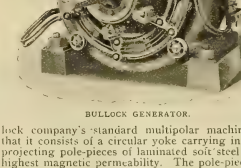
This one was upon the use of the Perrin multiple switchboard, and I will say that the decision as rendered does not concern us in the least, as we never have, since the commencement of business, operated under anything but the "trunking system," which is open to the free use of the public. While our original board was constructed for either multiple or trunking work, all recent additions have been purely trunking sections; hence we must operate under that system and cease to operate under the multiple. The decision simply restrains us from using something we do not wish to use and would not use if we could.

As for an accounting, that was waived in open court by the Bell attorneys, there being no showing whatever for damages. They pay their own costs in this case.

CAPITAL TELEPHONE AND TELEGRAPH COMPANY,
M. J. Dillman, vice-president and general manager.
Sacramento, Cal., April 8, 1898.

Bullock Generator.

The Bullock Electric Manufacturing company is the manufacturer of the generator shown by the cut. This machine is designed for direct connection to engine. The general design is similar to the Bullock company's standard multipolar machines, in that it consists of a circular yoke carrying inwardly projecting pole-pieces of laminated soft steel of the highest magnetic permeability. The pole-pieces are cast-welded into the frame, thus forming a more substantial joint, both mechanically and magnetically. This generator is built in six standard sizes, ranging from 25 to 200 kilowatts.



BULLOCK GENERATOR.

These generators are compounded to compensate for drop of potential in the line. The shunt and series coils are wound on separate forms, and are removable at will. The field coils are so wound that they are open for the circulation of air, and perfect ventilation is assured. All the compound

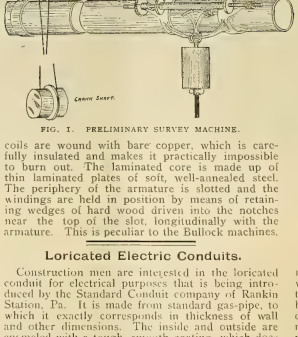


FIG. 1. PRELIMINARY SURVEY MACHINE.

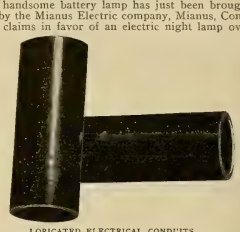
coils are wound with bare copper, which is carefully insulated and makes it practically impossible to burn out. The laminated core is made up of thin laminated plates of soft, well-annealed steel. The periphery of the armature is slotted and the windings are held in position by means of retaining wedges of hard wood driven into the notches near the top of the slot, longitudinally with the armature. This is peculiar to the Bullock machines.

Loricated Electric Conduits.

Construction men are interested in the loricated conduit for electrical purposes that is being introduced by the Standard Conduit company of Rankin Station, Pa. It is made from standard gas-pipe, to which it exactly corresponds in thickness of wall and other dimensions. The inside and outside are enameled with a tough, smooth coating, which does not crack when the conduit is bent, and no lining is used. The tubes are in 10-foot lengths, with a coupling on one end and a thread on the other. The interior of the tube is smooth. If need be, light wall tubing can also be furnished, when specially called for. This loricated conduit, it is claimed, excels in the ease and economy with which it can be installed, and its quality is attested by the fact that it has been approved for use by the National Board of Fire Underwriters. Robert Garland, the treasurer, announces that the material has recently been installed in the following buildings: Post-office, Washington, D. C.; Carnegie Library, Homestead, Pa.; Carnegie Library, Lawrenceville, Pittsburg; Commercial National Bank, Monongahela National Bank, Joseph Horne & Co., Pittsburg Leader, Daub and Murtland buildings, Pittsburg; and the Eleventh Ward School, Allegheny City. The company is busy on a variety of contracts, and will be glad to receive inquiries and give estimates or other information.

Mianus Battery Lamp.

A handsome battery lamp has just been brought out by the Mianus Electric company, Mianus, Conn. The claims in favor of an electric night lamp over



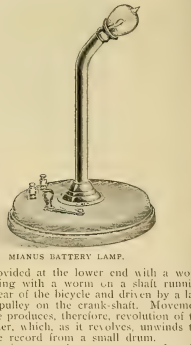
LORICATED ELECTRICAL CONDUITS.

an oil lamp, which is smoky, emits carbonic acid and consumes the oxygen of the air, are undisputed. This electric lamp, which can be placed near the clock on a table, has a switch attached to its base and can therefore be easily manipulated. Dry batteries are used for the lamp, which will, it is said, last a year without attention. The box has binding-posts, so that wires can be run from posts on the lamp to posts on the box. The lamp may be used as a hall light or in any place where an occasional light is required.

Preliminary Survey Machine.

The demand for a speedy method of making preliminary surveys without the usual array of engineers and instruments seems to have been met by a device recently invented by John Riddell of the General Electric company, Schenectady, N. Y., and entitled an instrument for delineating topographical peculiarities and measuring and recording distances. It is small and compact and may be mounted on a bicycle or upon any wheeled vehicle drawn by horses or pushed by hand or foot. It is shown in Fig. 1 mounted on the horizontal upper bar of a bicycle and consists, briefly, of a vertical revolving cylinder carrying the record and a marker moved upwards and downwards by the inclination upwards or downwards of the upper bicycle bar.

The metal cylinder carrying the paper for the record is provided at the lower end with a worm wheel engaging with a worm on a shaft running toward the rear of the bicycle and driven by a lace belt from a pulley on the crank-shaft. Movement of the bicycle produces, therefore, revolution of the record cylinder, which, as it revolves, unwinds the paper for the record from a small drum.



MIANUS BATTERY LAMP.

The marker is mounted on a nut on a threaded vertical rod. The lower end of the rod is fastened to a horizontal disk free to move clockwise or the reverse. Beneath the disk, and just clearing it on each side, are two smaller disks, at each end of a toothed sleeve, and revolving vertically. Through the sleeve passes the disk-shaft provided with a gear wheel meshing into a small gear on the main shaft driven from the crank axle.

Suspended beneath the bar of the bicycle, and consequently beneath the entire machine, is a pendulum having at its upper end a toothed quadrant meshing into the teeth of the sleeve on the shaft carrying the vertical disks. As the small disks revolve in the same direction, one in contact with the

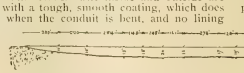


FIG. 2. PRELIMINARY SURVEY MACHINE.

large horizontal disk revolves it clockwise and causes the marker to ascend, the other counter clockwise depressing the marker. The nearer the center of the large disk the small disk comes, the faster the former moves and the sharper the angle described by the marker.

It will be seen that the pedulum hangs vertically whatever be the angle of inclination of the bicycle. If the machine is ascending the horizontal bar assumes an obtuse angular position to the pendulum, the rear vertical disk is brought beneath the horizontal disk and the marker moves upward; if a declivity is descended the angle of the bar and the pendulum becomes acute, the forward disk comes into play and the marker moves downward. On the level both vertical disks are out of contact with the horizontal disk and the marker records a plain horizontal straight line.

A part of a record is shown in Fig. 2. The number of feet above the level is shown by the horizontal line, the distance traveled by the length of the record. It is part of a record made on a wheel ridden from the gates of the General Electric company's factory to the main street of Schenectady.

The value of a device of this character will readily be appreciated by military, civil and railroad engineers. At present if a piece of road requires survey, or the lay of the land in a certain direction is to be ascertained, a system of survey is necessary involving considerable time and labor. Recent mention was made of the rapidly accomplished survey of 49.22 miles in 19 hours by means of a bicycle and compass. The mapping of the line surveyed occupied several hours additional labor. With a device of the character mentioned the completed topographical profile could have been ascertained in the time taken to propel the wheel over the length of the road surveyed.

Illinois Electric Company.

A new corporation which has recently opened offices and salesrooms at 239 Madison street, Chi-

Frank E. Healy.

Lemuel K. Cushing.

Carl Keith.

cago, will be known as the Illinois Electric company and will make an urgent bid for popular favor. The personnel of the corporation is a happy combination of utility and ability, consisting of F. E. Healy, president, L. K. Cushing, secretary, and Carl Keith, treasurer. All have seen service in the business in one of the largest supply houses in the West.

Mr. Healy, the president of the company, has been "brought up" in the electrical-supply business. Mr. Cushing, the secretary, is no new comer, besides he is a member of an electrical family and enjoys a tutelage from no less a personage than Prof. Elisha Gray. The telautograph had no sooner acquired a practical standing than Mr. Cushing, who had assisted in the development, was deputized to exhibit the invention, and in this capacity traveled throughout the country. Of late he has been engaged in handling electrical supplies.

Treasurer Keith started at the bottom of the ladder, and it is quite evident that his efforts to acquire knowledge of the business have been successful. He possesses a keen insight into financial matters, which coupled with his experience in practical service, will prove valuable to the already popular combination.

These energetic young men have already secured the agency for N. I. R. rubber-covered wires and cables, the high quality of which is well known, and the Edison, Jr., improved incandescent lamp.

Thermostatic Cable Endorsed.

The Gamewell Auxiliary Fire Alarm company of New York has completed a thorough examination of the Montauk Multiphase Cable company's system of thermostatic cables, and Joseph W. Stover, president of the Gamewell company, has notified the Montauk company of the result of these investigations in a letter containing the following statement:

Herewith we send you formal acceptance of your proposal for furnishing us with your "multiphase electric cables." After full consideration, we have come to the conclusion that we will find, through the use of your cable, something long known to be desirable but hitherto impracticable, viz. a device which we can safely use for the purpose of combining thermostatic fire-alarms with our auxiliary system of connection with public fire-alarm telegraphs.

The Montauk Multiphase Cable company originated and developed this new line of cables which, when installed for interior electric service, gives property owners and insurance companies an additional protection against loss by fire. This system makes wires sensitive to dangerous heat or flame so that they will automatically notify any point desired of the existence of such heat or flame at its inception. The value of these cables is in the fact that they are not required to be especially installed for this purpose, but, on the contrary, are used in buildings for all of the interior electric work required, and every additional wire or cable installed under the Montauk cable system is continuously thermostatic, and results in giving protection from loss by fire, although installed for purposes of an entirely different nature. Not only is the property holder benefited by gaining additional protection for life and property, but the insurance companies have an additional guarantee against loss through the use by the public of this system. The company places great value upon the endorsement and adoption of the system of interior, automatic, thermostatic, electric cables by the Gamewell Fire Alarm company and its auxiliary companies, as the Gamewell company is the parent of the present extensive fire-alarm system which is in use in over 700 of the largest cities of the United States, and has furnished more than 90 per cent. of all the fire-alarm apparatus used in the United States and Canada. The Gamewell company's experience extends over 50 years, during which it has tried many ways to give reliable and quick notification of fire. It is therefore with satisfaction that the main points brought out in the letter to the Montauk company are seen to be that this cable has received full consideration by the Gamewell people and that they have come to the conclusion that an automatic protection can be safely given in connection with their fire-alarm system where no other device has ever been relied upon; in other words, they are willing to rely upon the burning of this cable to close the circuit and thus automatically call out the forces of the fire department through their auxiliary system.

Canadian Electrical Association.

The executive committee of the Canadian Electrical association is making arrangements for the annual convention which is to be held in Montreal on Tuesday, Wednesday and Thursday, June 28th, 29th and 30th. The headquarters of the association during the convention will be at the Windsor Hotel, where the business sessions and the annual banquet will also be held.

The programme recommended by the local committee of arrangements was adopted, and is as follows:

First Day.—Executive meeting 9.30 to 10 a. m.; session, 10 a. m. to 1 p. m.; session, 2 to 5 p. m.; 7.30 p. m., trip around Mount Royal by special Park and Island cars, afterward ascending incline railway to lookout on mountain to view the city under illumination.

Second Day.—Session, 9 to 12, noon; cabs and buses from Windsor Hotel at 1 p. m. to visit the Bell Telephone company's new building, the street railway company's power house and the power house and works of the Lachine Rapids Hydraulic and Land company, returning to the city at 7:30 p. m.; 9 p. m., annual banquet of the association at Windsor Hotel.

Third Day.—Session, 9 to 12 a. m., election of officers and visit to McGill University; 1:30 p. m., visit to Royal Electric company's lighting station and factory, then by special Grand Trunk train to the works of the Chambly Manufacturing company at Chambly.

A number of interesting and instructive papers upon timely subjects have been promised.

The proposed extensions of the Atlanta Consolidated Street Railway company this spring will aggregate $3\frac{1}{2}$ miles.

Litigation over Trolley Patents.

In the injunction proceedings instituted by the Thomson-Houston Electric company against the Union Railway company the United States Court of Appeals has reversed Judge Lacombe's decision, in which he granted an injunction pending final hearing in the case, involving the Van Depoele underrunning trolley patent No. 495,443, controlled by the General Electric company. The Union Railway company is using the Walker company's apparatus, and the officers of the latter company claim that under the decision the right to make and use the trailing freely mounted trolley arm pressed up against an overhead conductor is now no longer limited to the General Electric and Westinghouse companies and their licensees. Testimony is now being taken in this case, it is explained, and the court believed that the injunction should not be issued until the decision was filed, as it was expected that this would be done in a very short time.

This is but one of a number of patents under which the Thomson-Houston company is proceeding against users of trolleys. Among the other suits is one under Van Depoele's patent No. 424,381, the special feature of which is the use of a tension spring occupying a horizontal position and pressing the trolley arm upward. This construction is universally used, as it permits the trolley arm to be brought down close to the roof of the car. Another patent under which suit is pending is No. 502,243, which relates to the use of oppositely acting tension springs, of which one set "rests" while the other is in use.

Another patent of Van Depoele under which suit is pending is No. 495,383, which covers the reversible trolley, that is to say, one which may swing freely around its vertical axis so as to trail in either direction.

Two other cases will be argued under the present week, one on the Anderson patent No. 412,155 and the other under the Baker patent No. 437,961. These patents relate respectively to means for conducting current from the trolley wheel to the harp, and to the use of buffer-springs for checking the motion from the trolley arm when it escapes from the wire.

WAR NEWS.

[*Continued from page 227.*]

The Kerite company has received a large order for submarine cables from the government. The order, conditional on early shipment, is for 65 miles of cable of varying size. In order to fill the order at as early a date as possible the works will be required to run night and day for several weeks.

Elaborate preparations are being made at New Orleans in addition to those undertaken by the government. Several local defense committees have been organized to co-operate with the administration at Washington. The chief state and city engineers are upon the committee of engineers and surveyors, and all the branches of engineering are covered by committees of experienced men. The foremost electricians of the state are on the electric-service committee, and the chairman, E. L. Bemiss, offers 60 generators and three 135 horse power engines with the fullest equipment for instant use, besides men for operating searchlight and electric service plants.

Telephone "Leaks."—A curious story comes from Washington, to the effect that the use of the local telephone exchange presents an opportunity for "leaks." In consequence private lines have been established between the White House and the offices of Secretary Long, Secretary Alger and Assistant Secretary Day. The instruments will be placed on the desks of the president and his three advisers. A great deal of the business to be transacted must necessarily be of the most confidential nature, and without some such private means of communicating it will be necessary for the secretaries to make frequent calls on persons at the White House. This the officials have not only found tiresome, but it has subjected their calls to publicity and themselves to embarrassing inquiries. In the event of war it has been arranged to take charge of certain telegraph lines and place specially engaged operators in charge, who will handle all government messages. Two or three telegraphers are kept at the State Department all day and night to receive cablegrams directly from Madrid and Havana.

Electrical Men Offer Their Services.—Captain Eugene Griffin of the General Electric company, formerly of the army, has shown his patriotism by undertaking to organize an auxiliary corps of electricians to serve either in the army or navy in case of war. In doing this, says the New York Sun, Captain Griffin has the approval of the secretary of war and of Brigadier General John M. Wilson, U. S. A., chief of the Engineers' Corps. Several days ago Captain Griffin went to Washington to inquire of the chief of the Engineers' Corps if he had at his command a sufficient force of skilled electrical workers to prepare and plant submarine mines and torpedoes in case such work had to be done in haste. General Wilson replied that he had not, adding that there were then in the service only enough men to assign one man to about every 40 miles of the coast. Learning this, Captain Griffin offered to undertake the formation of an auxiliary corps, provid

ing the secretary of war would approve. This approval was readily obtained, and with it went the secretary's grateful acknowledgment of Captain Griffin's offer. Captain Griffin returned to New York and immediately went to work. He obtained a list of the most skillful workmen in the employ of his own company. By letter he informed each of them what he wanted and asked if they would volunteer for the service. In his correspondence Captain Griffin made it clear that in case of war the volunteers might be called upon to make needed repairs on warships after their service in the army was over. He also stated that in case the government had need of their services, they would draw their pay from the company during all the period of service, as well as pay from the government, with the privilege of going back to their old jobs when the war was over.

He then wrote to other electrical companies in New York telling them what he wanted to do and what he had done and asked them to co-operate with him. To electrical companies in Boston and Philadelphia he sent similar communications. The quickness with which the replies came was astonishing. From his own men Captain Griffin received the most loyal responses. Everybody to whom he wrote wanted to volunteer. The other electrical companies met the request in the spirit in which it had been made and promised not only co-operation, but many of them sent in the names of volunteers. Captain Griffin received favorable replies from the United States Electrical Supply company, from the Edison Electric company of Broooklyn, from the Mount Morris Electric Light company, from the Manhattan Electrical Supply company and from the Westinghouse company. From Boston came responses from the Edison Illuminating company, the Marlborough Electric Light company, from the Bell Telephone company and the Boston Telegraph company. A number of Philadelphia companies also responded.

The result was that in less than a week more than 1,000 men had been enrolled. Captain Griffin obtained the day and night address of every volunteer. These were sent to the office of the chief of the Engineers' Corps at Washington, where they are now on file. Some of the men have already been called upon for work in New York harbor and others will be at work in Boston and Philadelphia. A few have been sent to work in the harbors along the South Atlantic coast. It is thought that already enough have been enrolled to do all the emergency work that is needed. However, Captain Griffin is receiving additional names every day.

Frank W. Hawley has also offered to serve the government without pay at the head of a detachment of electricians.

Holland to Be Officially Tested.—The Navy Department has so far declined to purchase outright the Holland submarine torpedo boat, which is electrically operated. Acting on the advice of some of the experts, an official trial of the craft has been directed, and should it meet with the very rigid requirements laid down during Secretary Herbert's administration for this type of vessel the Navy Department will probably purchase the boat. Commander C. S. Sperry, formerly on duty in Washington as an ordnance officer, and now on duty at the New York navy yard, has been ordered to conduct the test.

Miscellaneous Notes.—According to a dispatch from Pittsburg, the Westinghouse Electric and Manufacturing company has begun to ship to the Brooklyn navy yard a lot of generators, motors, dynamos and wire to be used for the installation of electric power and lighting plants on board the merchantmen, old monitors and coasting steamers now being equipped by the government for service in case of war with Spain.

The Pennsylvania Electric company of Marietta has received a large order for telephones from the War Department, to be used for coast defense and signal stations along the Atlantic Coast. The company received instructions to rush the order.

What Electricity Has Done.

Dr. Elisha Gray has contributed several interesting articles to the Chicago Times Herald entitled "Elementary Talks on Science." The following is an abstract from a recent publication:

Electricity has given us a voice that can be heard a thousand miles, and not only heard, but recognized. It has given us a pen that will write our autograph in New York, although we are still in Chicago. It has given us the best light, both from an optical and a sanitary standpoint, that the world has ever seen. The old fashioned, jogging horse car has been supplanted by the electric trolley, and we no longer have our feelings harrowed with pity for the poor old steeds that pulled those human sardine boxes through the streets, with men and women packed in and hanging onto straps at the top of the car while everybody trod on every other body's toes at the bottom.

"In olden ti[illegible] a car
Drawn by a horse, it going far,
  And felt that we were blest;
Now the conductor takes the fare
And sticks a broomstick in the air
  And lightning does the rest.

"In other days, along the street,
A glimmering lantern led the feet,
  When on a midnight stroll;
But now we catch, when night is nigh,
A piece of lightning from the sky
  And stick it on a pole.

"Time was when one must hold his ear
Close to a whispering voice to hear,
  Like deaf men—nigh and nigher;
But now from town to town he talks
And puts his nose into a box
  And whispers through a wire."

So jogs the old world along. We sometimes think it is slow, but when we look back a few years and see what has been accomplished it seems to have had a marvelously rapid development. Something like 50 years ago a professor of physics in one of our colleges was giving his class a course in electricity. The electric telegraph was too little known at that time to cut much of a figure in the classroom, so the stock experiments were those made with the frictional electric machine and the Leyden jar. One day the professor had in one hour's time taken his class through a course of electricity, and at the end he said: "Gentlemen, you were born too late to witness the development of this great science." I often wonder if the good professor is ever allowed to part the veil that separates us from the great beyond and look down upon this busy world of ours in which electricity plays such an important part in our everyday life, and if so, what he thinks of that little speech he made to the boys fifty years or more ago.

Regulations for Patent Attorneys.

[Special correspondence of the Western Electrican.]

Washington, D. C., April 12.—For years the necessity for the establishment of a patent bar has been recognized. The laws governing the grant of patents are not as fully understood by the general public as they should be. The inventor, who for the first time seeks a patent, particularly if he resides at a distance from the larger cities, generally believes that all he needs in order to secure protection for his invention is a document issued by the Patent Office and bearing its seal. He does not know, apparently, that however valuable his invention may be, the patent issued therefor may, if not properly drawn, fail to protect him against infringers and be practically worthless and be no more in effect than a notice to all the world that the invention may be used by anyone without paying royalty to the inventor. Many such inventors, knowing of no patent solicitor in their neighborhood, trust their inventions to some pretended patent attorney, who, without the experience or qualifications necessary to render applicants for patent valuable service and without the high sense of obligation to the interests of his clients and with no purpose beyond securing fees from the inventors, spreads high-sounding, self-laudatory and utterly unprofessional advertisements broadcast over the country. Under the over-liberal rule of practice by which "any person of intelligence and good moral character may appear as the agent or attorney in fact of an applicant" not a few such attorneys have in the past been permitted to practice before the Patent Office, with the result that, on applications badly prepared and unskillfully and carelessly prosecuted, patents were issued which, while valid for all that they claimed, were worthless in that they failed to adequately protect inventions which, properly claimed, might have been worth thousands of dollars. Such practitioners, in not a few cases, have, through ignorance, inexcusable in those pretending to be competent attorneys, and in some cases through willful deceit, induced would be inventors to pay them fees for the preparation and prosecution of applications for devices which were upon their faces unpatentable and worthless. Such applications are of necessity rejected by the Patent Office, and the result has often been that the applicant not only loses the fees paid to the attorney, which are not inconsiderable, notwithstanding that such attorneys advertise to do their work cheaply and to prepare and prosecute the application for fees less than would fairly pay for conscentious and skillful work, but is sometimes led to believe the Patent Office untrustworthy and in league with unprincipled attorneys for the purpose of defrauding him.

In the interest of inventors and the public an earnest attempt to correct such abuses in the practice was made by the Patent Office during the past year. In consequence of disclosures of improper practices a rule was adopted requiring that all attorneys practicing before the Patent Office be registered. The rule went into effect on January 1, 1898, and has been generally accepted by practitioners.

National Electric Light Convention, Chicago, June 7th, 8th and 9th.

The most popular line from Cincinnati, Louisville and all points South to Chicago is the Big Four Route via Indianapolis; magnificent sleeping cars and unequaled dining car service. For maps, rates, etc., address E. O. McCormick, passenger traffic manager, Big Four Route, Cincinnati, O.

J. C. Morrison of Mora, Minn., has put in an electric plant for lighting his hotel.

CORRESPONDENCE.

New York Notes.

New York, April 11.—The great question, Will there be a war? forms the engrossing topic here with electrical men as well as with everybody else. As I write, the president's message to Congress is eagerly awaited, and everyone will be glad when the suspense is over. One effect of the war preparations of the government has been a demand for a large amount of electrical material, and much more will be needed. The management of the electrical exhibition to be held in Madison Square Garden next month announces that the exhibition will be given as announced, whatever the outcome of the difficulty between the United States and Spain.

Speaking of the electrical exhibition, it may be said that the outlook for the show is bright. The Brooklyn Polytechnic Institute and Dr. Samuel Sheldon, its professor of physics and electrical engineering, have loaned several interesting units and standards upon which precision in electrical measurements is based. Even the electrical public, while it hears a great deal of such standards, rarely sees them, and this exhibit therefore will be of technical and popular interest. The exhibit will include standards from the German Imperial Physico-technical Institute (Reichsantalt) whose celebrated work has been done under the guidance of such men as Helmholtz and Kohlrausch; and it is probable that these standards have never before been exhibited in public in this country.

The Rapid Transit Commission has decided that the Manhattan Elevated people must accept or reject the new franchises in their entirety. The company will not be allowed to pick out the profitable downtown franchises and reject the others; it must take all or none. The commissioners have adopted the detailed plans and specifications for the construction of the tunnel road, together with the form of contract. The commission will not advertise for bids for the construction of the tunnel until the contracts have been submitted for approval, as required by the act, to Corporation Counsel Whalen. The act, however, insists that the contract shall be returned by the corporation counsel within a reasonable time, and the commissioners are determined that their plans shall not be further obstructed by any undue dilatoriness on the part of Mr. Whalen.

Last week, after having a force working night and day for some time, the Metropolitan Street Railway company was enabled to run its first underground electric cars on Second avenue. Starting from One-hundred-and-twenty-ninth street, these cars run south along Second avenue to Stuyvesant street, through which street the line swings westward to Astor place. Some of the cars at the juncture of Fourth avenue and Astor place again turn southward and run to the Brooklyn bridge over the tracks of the Fourth avenue line, while others of the cars continue on to the terminus of the line, at Astor place and Broadway, where a transfer is given to the Broadway line.

The Sun makes the following interesting note: "At that busy corner, Grand street and the Bowery, there may be seen cars propelled by five different methods of propulsion—by steam, by cable, by underground trolley, by storage battery and by horses. Overhead, running up and down the Bowery, are the cars of the elevated railroad, drawn by steam locomotives. Running up and down the Bowery on the surface are the cars of the Third avenue railroad, drawn by cable. The Madison avenue cars, which turn into the Bowery at this point, coming along Grand street from the west, are run by the underground trolley system. The cars of the Second avenue railroad, which come up the Bowery and turn into Grand street going east, returning around the same corner going down, are still drawn by horses, as are also nearly all the cars of the Grand street crosstown line, which crosses the Bowery going east and west. But there are four cars now running on the crosstown line that are run by power from a storage battery."

It is stated that the Edison Electric Illuminating company of this city has purchased an acre and a half of ground fronting on the East River, where it is proposed to erect the largest electric-lighting station in the country. W. F. O.

Northwestern Notations.

Minneapolis, April 11.—The Twin City Rapid Transit company will change its Selby avenue cable in St. Paul to electric about June 1st. The company has let contracts for devices to overcome the heavy grade and expects to begin work changing the line about May 1st. The company will build a second interurban line between Minneapolis and St. Paul, and have it completed by July 1st.

A mass meeting at Henning, Minn., appointed a committee to secure estimates of cost for an electric-light plant.

A. D. Holliday, a village trustee at Two Harbors, Minn., has secured estimates of cost for an electric-light plant. It is probable that the village will take steps to put in a plant.

The city of Superior, Wis., is taking bids until April 30th for furnishing and installing a municipal electric-light plant.

Valley Junction, Ia., will probably take up the

matter of electric lights this season. The matter was favorably voted on a year ago.

C. W. McElyea of Ames, Ia., contemplates an electric line from Cedar Falls, Ia., to Des Moines. Arrangements are said to have been completed for its construction as far as Eldora.

The Lewiston Light company of Lewiston, Idaho, has contracted for a 200-kilowatt alternator. The plant is to be located on Asotin Creek, 10 miles above Lewiston, and will be run by water power.

The city of Algona, Ia., has voted for electric lights.

The survey for the proposed electric railway between Minneapolis and Anoka, Minn., shows a grade of but 18 inches to the mile on the east side of the river. The prospects for the construction of the road this spring are regarded as bright.

The Watertown, S. D., Water, Light and Power company contemplates putting in an electric light plant.

R. R. Dunn of St. Paul, who is interested in the Minnesota Point street railway in Duluth, Minn., says that in time the line will be changed to broad-gauge and electric power used.

A summons and amended complaint has been filed at Eau Claire, Wis., in the case of the National Electric Manufacturing company. The complaint alleges conspiracy, fraud and swindle. The plaintiffs are T. A. Harrigan and Morgan Brooks of Minneapolis, Fred Bonell and the Edward P. Allis company of Milwaukee, and the Eureka Tempered Copper company of North East, Pa. The defendants are the National Electric Manufacturing company, J. T. Barber, H. H. Hayden, Fitch Gilbert, R. E. Rust, G. T. Thompson, John S. Owen, D. R. Moon, A. J. Rust, T. F. Frawley, Bank of Eau Claire, Chippewa Valley Bank and Westville Lumber company. The case will be a warmly contested one.

Frazee, Minn., has completed arrangements with the Commonwealth Lumber company to furnish electric street lighting.

The street-railway company at West Superior, Wis., is preparing to change its tracks to standard gauge, so that cars can run through from Duluth without change. Thomas Lowry of Minneapolis, who is interested in the company, has been in the city looking the system over.

The mayor of Butte, Mont., vetoed the ordinance granting the street railway company a right-of-way for a line to Walkerville, a suburb. The council agreed with the company and passed it over the mayor's veto by an overwhelming vote.

A tramp stole 300 feet of insulated copper wire in Eau Claire, Wis., from the street railway and tied up the line for four hours. The man cut the wires after the power was off in the early morning and burned the insulation off by fire. The fellow was caught trying to dispose of it at a junk shop and arrested.

The Western Union Telegraph company has enjoined the county treasurer in Seattle, Wash., from levying on and attempting to seal its personal property to satisfy personal taxes for $174.68, and to accept in full payment of such taxes $52.18. The company was taxed on royalties and patent rights which it claims it does not own and, therefore, should not be taxed upon. C.

PERSONAL.

Charles A. Boyd, superintendent of the Walker company of Cleveland, has resigned his position. He will enter business for himself, doing general engineering, with offices in the American Trust building, Cleveland, O. Mr. Boyd has been with the Walker company for the last four years, starting as engineer in the railway-motor department, having charge of the design and construction. About one year later he was placed in charge of the entire engineering department, and was promoted to the position of assistant superintendent on January 1, 1897. The following March he was appointed superintendent of the Cleveland works, having in charge both the engineering department and shops.

ELECTRIC LIGHTING.

James C. Fredlock of Piedmont, W. Va., has received contract from the city for electric lights and will establish a plant.

Sealed proposals will be received at the office of the city clerk of Natchez, Miss., until Thursday, June 2d, at 4 p. m. for lighting the streets, alleys, parks and public buildings of the city with electricity for a term of 10 years, from March 1, 1899, in accordance with plans and specifications on file in the clerk's office. The mayor and aldermen reserve the right to reject all bids. Specifications will be furnished those wishing to bid, upon application to the city clerk, Thomas R. Quarteram.

ELECTRIC RAILWAYS.

It is stated that the Cumberland (Md.) Electric Railroad company has decided to build an extension four miles long into the suburbs.

The Collins Park and Belt Railroad company of Atlanta will probably extend its line to Marietta, Ga., within the next few months. The plan is to build an extension of from 14 to 19 miles.

Crage & Tench of Buffalo have secured the contract for building the Lima and Honeoye Falls electric railroad. The contract also includes the wiring of the streets of both villages for electric lights, and the construction of the power house.

During the month of March the Metropolitan Elevated West Side Railway company of Chicago (electrically operated) carried a daily average of 68,597 passengers—the largest in its history. The receiver has now cash on hand amounting to $270,000.

A committee of the City Council of Chicago is considering a new street-car fender ordinance. This ordinance proposes to remedy the legal defects of the present ordinance by specifying that the fenders shall be of the steel-basket style. The ordinance gives the railways until June 1st next to equip all cars.

Mayor Harrison of Chicago has vetoed the ordinance passed by the City Council granting the Chicago, Milwaukee and St. Paul Railroad company permission to substitute electricity for steam upon its Evanston branch. The mayor objected that the compensation was inadequate, the term of the franchise (20 years) too long and the restrictions not sufficiently explicit. The veto was sustained.

ELECTRICAL SECURITIES.

The United Electric Securities company has declared a semi-annual dividend of $3.50 on the preferred stock, payable May 2d to stockholders of record April 20th. The last dividend declared was in February, 1896.

The Massachusetts railroad commissioners have authorized the Norton and Attleboro Street Railway company to issue $40,000 20-year five per cent. mortgage bonds, $22,000 of which are to be applied to the roadbed and rolling stock and $18,000 to electrical equipment.

For the month of March the earnings of the Brooklyn Rapid Transit company's system increased $58,627.31 over the same period of 1897 and $79,693.90 over 1896. For nine months ended March 31st the gain has been $176,453.47 over the same period of the previous year. For March, 1898, the total earnings were $466,387.66, and for the nine months $4,073,770.93.

The March earnings of the Brooklyn Elevated Railroad, compared with last year, show a decrease of $17,427, the road having earned only $132,856 against $150,283. The earnings reflect the diminution in traffic caused by the operation of trolley cars across the bridge. It is estimated that the Kings County Elevated earnings, which have not yet been made public, will show a loss of about $10,000.

MISCELLANEOUS.

It is stated that the employment of large electric overhead traveling cranes in locomotive shops is superseding the use of transfer tables. Several cranes of this description having each the capacity of lifting a complete locomotive are now in operation.

The United States Treasury Department is inviting sealed proposals until April 19th for installing an electric-light and power plant in the United States courthouse and postoffice building at Pittsburg. Specifications and plans can be obtained upon application to the secretary of the treasury, Washington, D. C.

A Sheffield correspondent of the English Hardware Trade Journal commends the promptness with which American manufacturers ship goods for the export trade. He tells of an English customer who cabled for 60 electrical specialties required for certain railways. These were promised in 14 days. "I should like to know," the buyer said, "where in this country I should get such smart attention." "Remember," he adds, "these electric goods thus hurriedly cabled for are not in stock; all have to be made." The correspondent is afraid that a good deal of trade which ought to be done in England is lost from such causes as this.

TRADE NEWS.

The Bullock Electric Manufacturing company will soon issue a bulletin on "Motors for Machine Tools and other Machinery."

The Westinghouse Electric and Manufacturing company has just opened a new branch office at Austin, Texas. Mr. J. E. Johnson will have charge of the office and of the further extension of Westinghouse business in the Southwest. The large contracts which this company has been handling in Mexico and the Texas region have led to the establishment of this new center of electrical trade.

Easter cards are not generally exchanged among commercial acquaintances, but the American Electrical Works has sent out a very pretty memento in the form of a representation of an egg-plant and a package of seed, with the injunction to plant the seed and raise a commemorative egg plant, at the same time expressing the hope that "its growth and fruit may frequently bring to mind" the American Electrical Works.

Moser & Wilson report that business with them is very good, and although they are putting on more help they cannot catch up with their orders. They have doubled their foundry capacity and are working a full force. They closed a contract April 4th with the Sprocket Brake company for 5,000 sprocket brakes to be used on bicycles, which will keep them busy for some time. The brass jobbing business is good and they say they are well satisfied with their prospects for the summer.

The electrical trade will be interested to know that a new electrical firm has opened offices in the Marquette building, Chicago. The new institution starts business under the name of Harding & Hammer. Both partners are already well known to the western trade. Mr. Harding has done business under his own name for years in the Marquette building, handling dynamos and electrical machinery of a general character. Mr. Hammer until some months ago was a partner in the firm of Cutler & Hammer. It may be stated incidentally that the new combination seems a most excellent one.

Eugene Munsell & Co. of New York and Chicago are enjoying an excellent trade on their India and amber mica segments for railway motors. Several heavy orders have recently been received, one of which was probably the largest ever taken for mica segments from an electric railway. It consisted of more than 800 pounds of the India and amber segments. The firm carries a large stock of mica, both in the sheet and cut to size, and has unequaled facilities, both at New York and Chicago, for executing orders promptly. It will take pleasure in sending samples for trial to any electrical manufacturer, repair concern or street railway that may request them.

A neat folder giving a complete list of all the vessels in the navies of the United States and Spain and showing classification, speed, number of guns, etc., has just been issued by the New York, Ontario and Western Railway company through the western passenger agent, E. T. Monett. The relative strength of the two navies can be seen at a glance, and an intelligent comparison made. Anyone can obtain one of these folders without charge by application to E. T. Monett, 120 Kinzie street, Chicago. The New York, Ontario and Western railway in connection with the Wabash railroad is the only line running through free reclining chairs between Chicago and New York.

The increasing application of storage batteries to electric-light and railway-station use, as well as to street cars, motor carriages, electric launches, etc., where a portable source of power is requisite, has led the General Electric company to develop a special type of meter which will show at a glance the amount of energy available in the battery. The Thomson recording storage-battery meter resembles in general appearance the standard Thomson recording wattmeter, and is, in fact, a development from it, the mechanism being almost exactly similar. The accuracy and durability characteristic of the standard type have both been maintained, while additional precaution is provided against injury from shock or vibration. The meter is provided with a single indicating needle moving over a horizontal semicircular dial.

C. W. Bartlett of Des Moines, Ia., has severed his connection with the Mutual Telephone company of that place to accept a position with the Keystone Telephone company of Pittsburg, Pa., as western agent with headquarters at Des Moines. Mr. Bartlett has made an enviable reputation for himself in building up the Des Moines plant to the high position it occupies to-day as one of the best independent exchanges in the country, and the practical knowledge thus obtained makes him well fitted to give expert information on telephone construction, what to use, and how to use it. Adding to this the high class of apparatus he will have in representing the Keystone Telephone company, he will occupy a position that will be of great advantage to exchanges in that section. The combination is a happy one.

A. L. Ide & Sons of Springfield announce the granting of a patent, dated April 5th, on a "combined shaft and disk." This refers to the well-known construction of the improved crank-shaft now used in the Ideal engines, consisting of shaft and disk of one piece of gun metal or one integral casting, with steel core or strengthening rod cast in the center of the shaft and made a part thereof. This construction has been used by Ide & Son for several years past, and owing to the great strength of this patented construction, out of several thousand engines equipped with these shafts, not one has failed to withstand the greatest strain of the most exacting service. The makers have found that the gun-metal makes a more serviceable, better wearing and more perfect bearing than a shaft where the steel comes in contact with the babbitt of the bearing.

The Davis & Egan Machine Tool company of Cincinnati will in the future be known as the American Tool Works company. The change of name goes with a reorganization of the concern, which includes an increase of the capital stock from $500,000 to $1,000,000. The steadily increasing foreign business of the company has necessitated its enlargement, and the change of name is made in the interest of this same foreign business. Mr. Charles Davis will be continued as president of the Ameri

can Tool Works company. The same line of manufacture, of tools for use in the manufacture of all kinds of tools used in the manufacture of machines and all metal work, will be pursued. The product of the concern is now said to be sold three months ahead. Mr. Davis, the president, will leave for Europe in two or three weeks, as soon as the reorganization is completed, to spend the summer on business.

Kohler Brothers will represent the Northern Electrical Manufacturing company of Madison hereafter as sales agents, with headquarters in Chicago. Their territory includes Illinois, Iowa, Missouri, Indiana, Nebraska, Kansas, Kentucky, Tennessee, Michigan, Ohio, Pennsylvania, New Jersey, Maryland, Delaware and District of Columbia. It may be said that not only in Chicago but throughout the territory in which this enterprising firm has operated it is recognized for ability and perseverance. There are few concerns in the country of this class that have a record for sales equal to that of Kohler Brothers. The Northern company has been making some improvements in its product as well as its factory, and it is now prepared to furnish a complete line of stationary motors for all classes of work. Its facilities for machines of which special requirements are demanded are unexcelled. A line of the company's motors will be exhibited at Kohler Brothers' offices in the Monadnock building.

BUSINESS.

The Buckeye Electric company is putting out a handsome catalogue of its special coiled-filament lamps. Consumers in western territory will be supplied on application to J. H. Cooke, 753 Monadnock building, Chicago.

The Cincinnati Screw and Tap company sends out a number of circulars, stitched together, to illustrate the variety of its goods. All kinds of bolts, screws and nuts for machines are shown and also machinists' tools. A complete catalogue is sent on application.

A neat booklet shows the electrical heating devices made by the American Electrical Heater company of Detroit. The electric soldering irons, laundry irons, tailors' irons, curling-iron heaters, heating disks and portable air heaters made by this company are guaranteed.

The Card Electric company of Mansfield, O., says that business never was better, and that it has been found necessary to run the shops at night. Important extensions to the factory have just been completed, and the company is looking forward to further additions in the early summer.

Huebel & Manger, Brooklyn, are receiving many orders for their style "F" skeleton bell. This bell is made in sizes ranging from three inches to 15 and is a most satisfactory signal and fire-alarm bell. For use in mines, factories, schools, hotels, etc., and on railroads it is especially recommended.

The Walker company announces a "converted type" of belted generator which is said to conform very closely in design and excellence to its direct-connected dynamos. A recent circular gives a description of this type, with illustrations.

A ventilating fan can be driven by a water motor as well as by an electric motor. The Schneider Manufacturing company of Cleveland says that water-driven fans are a success, laying stress on the low cost of maintenance; and it will send a circular describing its Gem and Globe motors on request.

The Pennsylvania Railroad company has ordered for its Altoona shops two 160 horse power tandem compound engines, arranged for direct-connection to 100-kilowatt dynamos. The engine was furnished by the Ball Engine company, Erie, Pa., and dynamos by the General Electric company. The city of Crowley, La., is installing an electric-light plant. Ball engines furnish the power. The city of Scranton, Miss., is installing a 75 horse power Ball engine, to be direct-connected to General Electric dynamos.

Mathias Klein & Son of 87 and 89 West Van Buren street, Chicago, are now issuing their catalogue No. 3, of linemen's construction tools, which they would like to see in the hands of everyone interested in line construction and maintenance. They will send the catalogue to anyone who will furnish his address. The firm is one of the oldest manufacturers of linemen's tools in the West, and its aim is to issue only first-class goods and at a price consistent with good quality. It is experiencing an active demand for climbers' splicing clamps, wire clamps and construction tools generally.

Descriptive catalogue No. 32 of the Holtzer-Cabot Electric company of Boston, Mass., is devoted to the company's new type of magneto bells and to its various telephone apparatus, which is claimed to be more extensive than that manufactured by any other concern in the country. The company's long experience of nearly 25 years places it in a position to know all about the necessities of the trade. This catalogue seems to cover everything that is needed in a telephone exchange, going minutely into detail of the various articles that would be called for by purchasers of telephone goods

Users of miniature incandescent lamps will very readily appreciate the advantage of having a miniature lamp of a standard reliable make that can be depended upon for efficiency and length of life. The Packard 3gn lamp, which is a miniature lamp about two inches long over all and one inch in diameter, fills the demand for a high-grade miniature lamp. It is mounted with regular Edison candelabra base, gives about two candle power and burns four in series on 50 to 60 volts, or eight in series on 100 to 120 volts. This lamp is carried in stock in Chicago in large quantities by the Electric Appliance company, which always holds itself in readiness to ship promptly any number of these lamps and the necessary sockets.

Walker, Bailey & Co., of Buenos Ayres, Argentin Republic, are now installing the first outfit of electric motors for supplying all of the motive power in a factory that has ever been installed in that country. The plant is for a weaving factory, and it is to be driven by Lundell electric motors of such power that each motor will drive six machines. The Lundell motor seems to be gaining rapid recognition among large power users, owing to the fact, it is stated, that it has never lost in competition with other motors at the hands of engineers, and the further fact that it has given invariable satisfaction during all the years it has been upon the market. One of the latest contracts awarded the Sprague company is that from the John Stephenson Car company of Elizabethport, N. J. Each of the Stephenson machines will have its independent Lundell motor, and the sizes used will be from three to 40 horse power, mostly large-size machines. Some of them will be direct-connected and some geared. In addition to the power motors, the Sprague company has secured a contract for exhaust fan outfits. The plant will be one of the largest of its kind in the country, and will employ only Lundell motors.

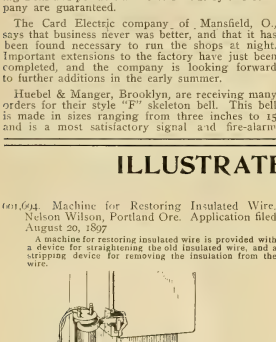
The Armington & Sims company of Providence, R. I., manufacturer of the Armington & Sims engine, reports that it is receiving a large number of orders and that the prospects for a continued trade are bright. The company recently took an order from the Quidnick Manufacturing company of Quidnick, R. I., for a 400 horse power slow-speed new type cross-compound engine. This will be the first of its kind built at these works, and is creating some little comment in engineering circles, owing to a number of changes in its construction. Among other orders recently taken was one for two engines to be delivered to the government for operating searchlights, to be delivered within five days; one for a 75 horse power high-speed engine for Mount Hope Fire, Providence, R. I., and an engine for the Wickford Woolen company. The placing of the order for the University Club of New York city, for an engine to be placed in its club house, was awarded to the Armington & Sims company after close investigation into the merits of the various engines offered for sale. One of the supprises the company has experienced in the way of new business is the receipt of an order for two small engines to be shipped to the Klondike. It is pleasant to note the success which has attended the efforts of General Manager Fred. M. Bushnell to place this well-known concern in its former position. Mr. Bushnell is now arranging a number of important changes to increase the capacity of the factory.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 5, 1898.

601,694. Machine for Restoring Insulated Wire. Nelson Wilson, Portland Ore. Application filed August 20, 1897

A machine for restoring insulated wire is provided with a device for straightening the old insulated wire, and a stripping device for removing the insulation from the wire.



NO. 601,805.

601,717. Solenoid Blow-out for Dispersing Arcs Formed in Breaking Electric Circuits. Sidney H. Short, Cleveland, Ohio. Application filed November 1, 1897

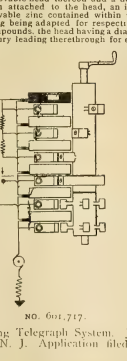
Separable contacts are arranged in an electric circuit with a spiral conducting coil arranged in proximity to the contacts, and a magnetic field circuit therewith, the coil being adapted to be included in the circuit of the contacts at the moment circuit is broken between the contacts.

601,730. Heat Detector for Electric Fire-alarm Systems. John D. Gould, Brooklyn, N. Y. Application filed January 30, 1896.

Included in this device are combined an insulated block a recess or chamber in the block, a bulb or globule or knob of fusible metal or compound of metal suspended over the recess, and two wires or conductors extending into the chamber independent of and insulated from each other, two other wires arranged in close proximity side by side but electrically separated from each other, one of the wires being formed of a metal fusible at a low temperature, the latter wires at one end being respectively connected to the wires of the block and respectively connected at their other ends to the poles of an electric battery.

601,758. Electric Lantern. Oscar C. Prasse, West New Brighton, N. Y. Application filed June 28, 1897.

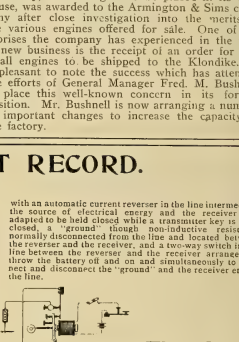
The special feature is a battery comprising a casing having a removable head thereon and a depending cylindrical carbon attached to the head, an inclosed porous cup and a movable zinc contained within the cup, the cup and the casing being adapted for respectively containing chemical compounds, the head having a diagonal vent containing mercury leading therethrough for escape of gases.



NO. 601,717.

601,768. Printing Telegraph System. John Burry, Fort Lee, N. J. Application filed September 10, 1897.

A receiver is provided with printing and polarized type-controlling electro-magnets operated by the line current, with an automatic current reverser in the line intermediate the source of electrical energy and the receiver and adapted to be held closed while a transmitter key is held closed, a "ground" though non-inductive resistance normally disconnected from the line and located between the reverser and the receiver, and a two-way switch in the line between the reverser and the receiver arranged to throw the battery off and on and simultaneously to connect and disconnect the "ground" and the receiver end of the line.



NO. 601,768

601,805. Telephone. Thomas F. Ahearn, Detroit, Mich. Application filed April 20, 1897.

A transmitter is suspended on a horizontal axis in a plane in or parallel to the diaphragm, so journaled that the speaking tube is normally downward, with means connecting the movable receiver hook with the transmitter, coupelling the latter to rotate so that the diaphragm is in substantially a perpendicular plane when the receiver is detached from the hook.

601,871. Electro-magnetic Circuit Breaker. Gano S. Dunn, East Orange, N. J. Application filed June 12, 1897.

A resistance controlling switch is employed to govern means for locking the circuit breaker against closure in certain positions of the switch and means for permitting the opening of the circuit breaker in all positions of the switch.

601,902. Electric Brake Mechanism. Alexis Van derbeck, Scammon, Kan. Application filed September 13, 1897.

A device is described having fixed electro magnets and a movable plunger operating axially through one electro-magnet, with its extremities permanently connected and the ends thereof, for attraction by the other, and adapted to be operatively connected with brake mechanism.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, APRIL 23, 1898. No. 17

Electricity at the Omaha Exposition.

Preparations for the formal opening of the Trans-Mississippi and International Exposition at Omaha on June 1st are rapidly nearing completion. The buildings have been erected and the work of improving and beautifying the grounds is already well advanced, leaving scarcely anything to be done save the ornamentation of the buildings and the reception and arrangement of exhibits. During the next few weeks this work will be pushed as expeditiously as possible, so that on the day set for opening the gates to the public the entire scene will have undergone a complete transformation and the spectacle presented will be one of surpassing beauty.

As its name implies, the exposition will be essentially representative of the trans-Mississippi region, and it is intended to fully illustrate the wealth-producing power and the extent of productive industries of the Great West, but the scope of the enterprise has expanded far beyond the limits of the original project, the national government and 35 states having recognized the importance of the event by actively participating in it and contributing towards its material success. Moreover, by direction of President McKinley the State Department extended invitations to rulers of foreign nations to participate, and these official invitations were supplemented by formal invitations transmitted by the president of the exposition company to the governments of all nations with which the United States maintains diplomatic relations. Many favorable responses have been received. The Canadian exhibit will be in all respects worthy of the Dominion government. The Central and South American states will furnish evidence of the material and industrial progress attained by those nations. Lord Salisbury, prime minister of England, has officially notified the secretary of the treasury that the British government is affording assistance to exhibitors and encouraging a representative display. The Chinese government has informed the authorities at Washington that it will be represented. President Diaz of Mexico has shown a personal interest in the affair. Mexico will send a characteristic exhibit, and he himself will send his renowned band. The government of Venezuela has formally accepted the invitation, and Costa Rica and Bolivia will send official representatives and join in making exhibits of the industries and products of their respective countries. So much for the international scope of the exposition.

The artistic features are equally well assured. The location of the grounds is admirably suited for the purpose, commanding a magnificent view of the river and being easily accessible and conveniently situated with reference to the business portion and residence part of the city. What is locally known as the Kountze tract, which is 670 feet wide and is defined by Sherman avenue on the east and Twenty-fourth street on the west, was selected for the focus of the group of main buildings. This ground is nearly half a mile long, and in the center there is a canal extending the greater part of the distance. This basin is 150 feet wide at the east end, and at the west end it runs into a trefoil or three-lobed lake 400 feet across. On the east is an area of 60 acres stretching along the bluffs and overlooking the river and country beyond. The remainder of the exposition ground lies north of Kountze tract, west of Sherman avenue, and includes the old fair ground, and the land beyond it, embracing in all about 80 acres.

The main architectural feature is bound to be the Grand Canal Court, and they will at once remind visitors of the magnificent Court of Honor at the World's Fair. The main buildings are ranged along either side of the basin. At the west end stands the Government building, flanked by imposing colonnades which converge toward the west. The Arch of States forms the main entrance on the south line at Twentieth street. Entering this arch the visitor arrives at the Court of the Grand Canal, opposite the Administration Arch, the Palace of Agriculture being on the west and the Manufactures building on the east. The canal or basin is spanned occasionally by picturesque bridges, built with little arches to permit the passage of gondolas and electric launches. Its two ends terminate respectively at the Government building on the west and at the viaduct on the east.

Although the grounds and buildings will be attractive by day, the real beauty and grandeur of the conception can only be appreciated at night when with the aid of electric lights the scene presented will rival a picture of fairyland. Every building will be outlined with incandescent lamps—cornice, window, pillar, dome and water-edge. The salient points of the Government building architecture will be made distinct by electric starpoints. On either side will be defined the colonnades which connect the sister buildings by pillars of light. To the left the Fine Arts building will rivet the attention with domes light-encircled, cornices ablaze, pillars and pilasters illuminated. On the opposite side of the lagoon is the classical Agricultural building. It presents a brilliant opportunity for incandescent decoration. The upper lines, including the balustrades, and the imposing entrance and corner towers, will stand revealed by the numerous electric punctuation points. The Administration Arch will raise its lofty spire outlined in symmetrical lines of light to the uppermost point. The Manufactures building will have the prominent roof cornices, caps of columns, pedestals and other points of vantage embla zoned with incandescent lights, and the Arch of States will be girdled with bands of light, while the Liberal Arts building will be vividly outlined along its cornices. The Mines and Mining building is especially adapted for this beautiful decoration, and right royally has it been bedizened and crowned

FIG. 1 ELECTRICITY AT THE OMAHA EXPOSITION.—VIEW OF MACHINERY AND ELECTRICITY BUILDING FROM THE WEST

its graceful portico clearly defined, the towers wearing scintillating crowns and the windows shining brightly. Facing this structure is the palace of Machinery and Electricity, with all effective points penciled in light. The east end of the lagoon, in front of the last two mentioned buildings, in company with the adjacent terraces, landings and broad viaduct leading away from it, will be brilliantly lighted by incandescent lamps supported by fanciful standards of special design.

Several special features have been designed. Surmounting the Government building is the heroic figure of Liberty Enlightening the World, holding

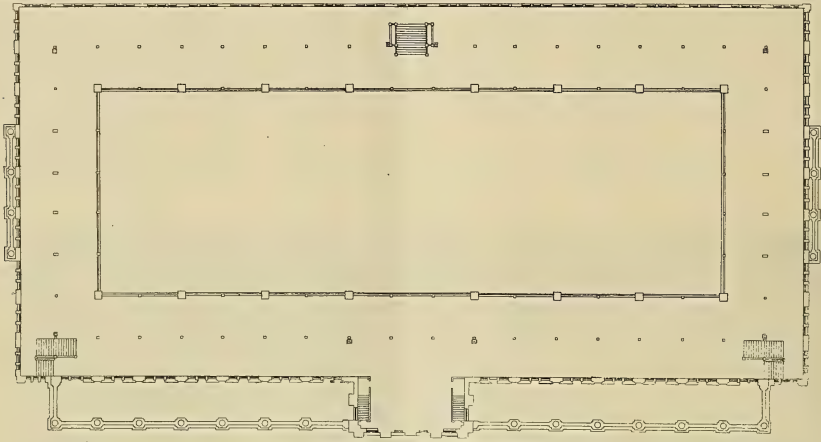


Fig. 2 Plan of Gallery of Machinery and Electricity Building.

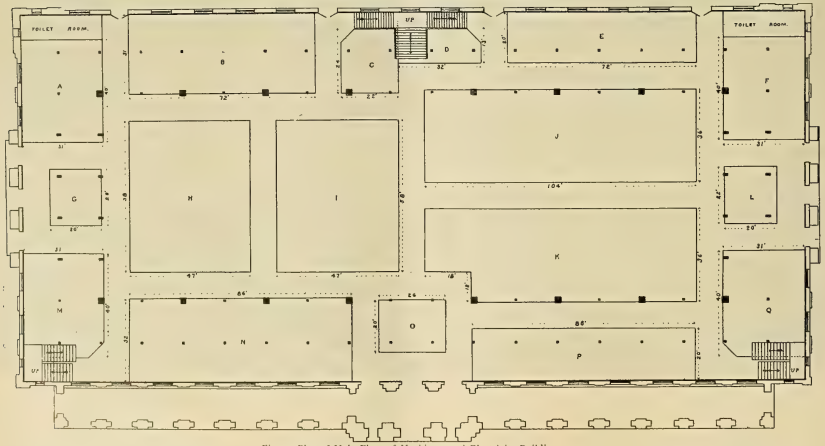


Fig. 3. Plan of Main Floor of Machinery and Electricity Building.

ELECTRICITY AT THE OMAHA EXPOSITION.

tilus" will be bombarded from an invisible source with light ever-changing in color and of great intensity, enshrined in luminous floating lilies. Mr. Stieringer designed the lighting effects, and those who have examined his plans and followed the progress of the work declare that this will be the most striking feature of the exhibition.

The commanding position of electricity and the popular interest in this department has been recognized by the management in devoting one of the main buildings conjointly to machinery and electricity. An excellent picture, reproduced from a recent photograph of the building, is presented in

corners. A high central court 248 feet long by 80 feet wide is lighted from the skylights and clerestory windows above the roof.

The character of the exhibits sheltered by this building will be shown by the decoration, which has not yet been completed. The ornamental spandrels and panels will receive all of their motifs and suggestions from machinery. In the plans the cresting at the top is composed of cogwheels, this principle being carried out in all of the decorations. The underlying principle and function of machinery is symbolized by the groups of statuary on the top of the building. At each of the four corners are

a powerful searchlight aloft. Liberty's body is to be jeweled with incandescent lamps; about her head there will be a scintillating tiara, and the upheld torch encircled with lamps. Beneath the figure several lines of light will completely girdle the cupola above the dome. Streamers of light will cover the dome, apparently held to their places by five-pointed stars on either side of the dormer windows, and below these another line of light will completely surround the base of the dome. Arising from the roof of the central portion of the building a series of flambeaux supported on shafts of artistic design will cast their radiance on surrounding objects. The allegorical figures on the upper cornices and flanking the dome will be outlined harmoniously and effectively. Clusters of lights border the Mirror, and in the center of this charming scene the electric fountain "Nau

Fig. 1. The diagrams show the floor plans for the gallery (Fig. 2) and the main floor (Fig. 3). This building is located in the northeast corner of the grand court, being east of the Manufactures building and across the lagoon from the Mines building. It has a frontage of 304 feet and is 144 feet deep. There are triple entrances on the main-floor level in the center of the main front and similar groups in the centers of the east and west fronts, with four emergency exits in the north wall. In front of the building, flanking both sides of the main entrance, is an open portico 16 feet wide, running the entire front of the building. Above the main floor is a gallery 32 feet in width, extending around the four outer walls. The gallery is reached by spacious staircases located at convenient points in the building. Commodious toilet rooms are provided in the rear

groups representing the early supremacy of man over the untamed forces of nature. These forces are represented by wild animals. Men in their youth are seen subduing them for the simple purpose of escaping injury and the preservation of their own lives at the sacrifice of the natural forces. A higher supremacy is shown by the center group, which is the dominating feature of the entire design. In this, man, developed beyond the youthful stage, having wisdom, takes these untamed, unharnessed forces of nature, and harnesses them to his chariot, making them do his bidding, symbolizing in a direct way the service which machinery does for man in using the powers of steam, electricity and gravity.

Color enters into the design with maximum importance. The ornaments in the panels under the

porticos and over the main entrances will be highly emphasized by small background spaces of strong colors. The entire building will be a series of yellow and ivory tones, growing more intense as they reach the top, culminating in the dull golden stationary which surmounts the building and symbolizes its use. The building was designed by Dwight H. Perkins of Chicago.

Among the electrical features that will be shown in this building will be the latest developments in power transmission, a working telephone exchange, a miniature central-station plant and personal exhibits by Edison, Tesla and Thomson. Prof. R. B. Owens is at the head of the Department of Electricity.

Coupling Switches for Accumulators.

Dr. Ch. Truchot of the Clermont-Ferrand University recently contributed an article to the Archives d'Electricité Médicale, in which he described

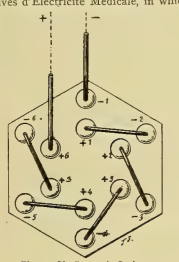


Fig. 1. Six Groups in Series.

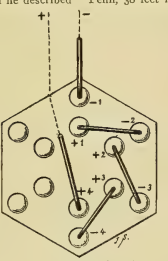


Fig. 2. Four Groups in Series. Two Groups Idle.

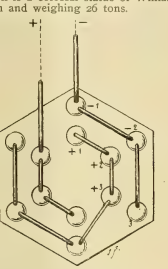


Fig. 3. Three Groups in Parallel. Two Groups in Series.

COUPLING SWITCHES FOR ACCUMULATORS.

a new combination of switches to control the output of a battery, changing at will the quantity and tension of the current discharged. For his own convenience the doctor had installed a storage-battery plant which he used in electrolytic and cautery work, for lighting, and for driving motors for static machines. Current for charging was taken from a dynamo delivering 10 amperes at 55 volts.

The battery comprised 30 elements of 70 ampere-hours, discharging normally 12 amperes. The elements were arranged in six groups, each comprising five accumulators, connected by soldered contacts. To effect the changes and combinations desired, the doctor made a block of insulating material, hexagonal in shape, with 12 cavities arranged as shown in Fig. 1. The six positive wires were brought to the six interior contacts, and the six negatives were brought to the outer cavities. These cavities were filled with mercury, and a connecting bridge of copper wire placed across two of these terminals connected them. To group all of the elements it was only necessary to place them as shown in Fig. 1, —1 being one pole of the combination and +6 the other pole. If it is desired to connect up 20 elements only, the arrangement shown in Fig. 2 will accomplish this, leaving one-third of the battery idle. Fig. 3 shows a more complicated arrangement, namely, three groups in quantity and two groups in tension. It will be readily understood from an examination of these three figures that many combinations of quantity and tension may be secured with a large battery plant, and any chosen number may be discharging while the remainder are being charged.

"Curious Things Electrical."

Frank L. Perry, the assistant business manager of the Western Electrician, delivered an illustrated lecture on "Curious Things Electrical" at the Kenwood Evangelical Church on the evening of April 14th for the benefit of a West Side church. Mr. Perry's lecture was a popular exposition of the applications of electricity. He performed several interesting experiments, displayed a large number of stereopticon views and read letters from Elihu Thomson, Graham Bell and Tesla, detailing the most curious electrical experience of each of these gentlemen. Mr. Perry's lecture showed exhaustive preparation, and he was heartily applauded. In particular, his graphical explanation, in colors, of the principle of the rotary magnetic field of the Tesla motor deserved praise for ingenuity and effectiveness

Introspection.

(From the London Electrician.)

Our great fault, as a nation, is excess of conservatism; and the incubus of numerous and important vested interests conspires with that fault to throw obstacles in the way of radical changes in our industrial methods. Our engineering manufacturers are, however, awakening to the fact that such changes are imperative; and, whether by the importation of American labor-saving apparatus and American ideas, or by rousing ourselves into activity to devise such apparatus for ourselves, the retention of that supremacy in engineering industry which Great Britain has hitherto held can only be insured by falling into line with the new order of affairs, and adapting ourselves more perfectly to a palpable change in our commercial environment.

A Big Job of Electroplating.

In a recent paper read before the Engineers' Club of Philadelphia by Mr. Francis Schumann on "The Metal Dome of the City Hall Tower, Philadelphia, Pa.," there is an interesting description of the process of electroplating 120,000 square feet of surface of the cast-iron shell of that dome. The tower is 548 feet in height and weighs over 60,000 tons. It is built of masonry for a distance of 337 feet from the ground; above this shaft is the dome which Mr. Schumann describes. The crowning feature of the work is a colossal statue of William Penn, 38 feet high and weighing 26 tons.

The portion of the paper relating to the electroplating of the shell of the dome is as follows:

The electroplating of the shell of the tower was performed in a building especially erected for that purpose. It was 60 feet wide by 120 feet long, of heavy framework of wood, one story high, sides and roof covered with corrugated iron. A row of timber posts, supporting the middle of the roof trusses, divided the floor area into two clear spaces. The north space contained two rows of pits, three in each row, made water-tight by concrete and cement sides and bottoms. The pits were of dimensions to receive the plating tanks, and of such depths that the rims of the tanks were about 18 inches above the floor level, and of sufficient width and length to leave a space of eight inches between the outside of the tanks and walls of pits. This space was kept full of water to a level with the surface of the liquid in the tank, and thus acted as a counterpoise to prevent both the bulging of the sides of the tanks as well as to prevent leakage, the hydrostatic pressure being the same on both inside and outside of the tanks.

Over the center of each row of pits, and attached to the under side of the roof trusses, was a track made of 10 one-half-inch rolled beams, carrying three trolleys and chain-hoists, each of sufficient capacity to raise three tons. The trolleys were moved back and forth on the tracks by means of a system of ropes running over sheaves and leading to geared drums operated by hand cranks.

The tracks, which extended beyond the tanks, permitted the transportation of a piece to be plated, by means of the trolleys, from place to place, as might be required, the raising and lowering being done with the chain-hoists.

At the end of the rows of tanks was located the cleaning floor, having a small tank supplied with running water.

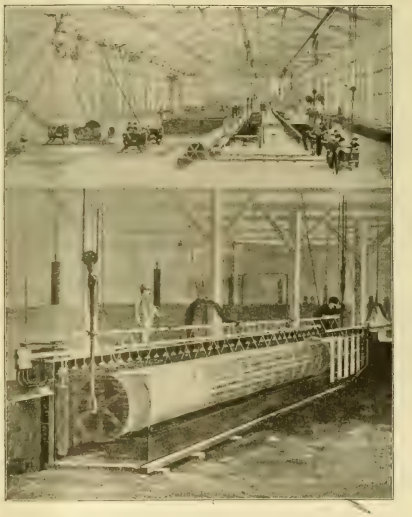
The other or south space of the floor was occupied in part by a 75 horse power boiler and 50 horse power steam engine, four dynamos, storage room and work benches for marking, inspecting and assembling the piece for shipment.

The first row of plating tanks were:

1. Caustic-soda tank, of plate-iron, five feet wide, five feet deep, and 31 feet long. The temperature of the solution was maintained at about 210° F. In this the articles were immersed from two to six hours, for the purpose of removing all grease or fatty substance. From this tank the piece was taken to the

2. Pickling tank, made of wood, same dimensions as last, lead lined, and containing a 10 per cent. solution of sulphuric acid, at a temperature of about 150°, the article being immersed from two to six hours to loosen or remove all rust, silica or other matter, the cleaning being by scraping and rubbing with wire brushes, which was done at the cleaning floor, previous to treatment in the

3. Alkali-copper tank, also of wood, and of same dimensions as the last. This bath was about 150° temperature, and was the first in which a deposit of copper or alloy of copper and tin was applied. The anodes were hung to 1¼-inch diameter brass conductor rods, supported on short brackets at both sides of the tank, while the cathode, or piece to be plated, was hung to a single two-inch diameter brass conductor rod, suspended over the middle of the tank by means of ropes over sheaves overhead balanced with counter weights. The round conductor rods were connected to flat copper conductors from the dynamos by flexible copper wire strands, to permit shifting of the round rods. The time of plating was about 24 hours, under four volts and from 1,000 to to 2,000 amperes.



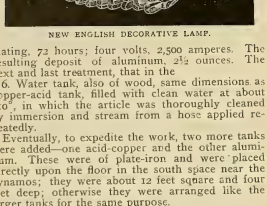
A BIG JOB OF ELECTROPLATING. VIEW OF PLANT, SHOWING A 1000-POUND COLUMN IN THE BATH.

From this tank the piece was taken to the second row of tanks, the first being the

4. Acid-copper tank, similar in all respects to the last, except that it was lead-lined and not heated, and that the conductor rods were respectively two

and 2½ inches in diameter. At one end of the tank, in a corner, an agitator for effecting circulation of the liquid was located, consisting of an upright copper tube about eight inches diameter, within which a small propeller wheel secured to a vertical spindle revolved, driven from the line of shafting. The anodes were of copper, and time of plating 72 hours, depositing about 14 ounces of copper to a square foot of surface. The voltage was four and amperage from 1,000 to 2,000. The next was

5. Aluminum tank, of wood, five feet wide, eight feet deep, and 31 feet long. This bath was heated to about 180° by means of steam-pipe coils lying at the bottom of the tank. The anodes were of aluminum alloyed with 15 per cent. of tin; conductors 1¾ and 2 inches diameter respectively, otherwise same as acid-copper tanks. Time of



NEW ENGLISH DECORATIVE LAMP.

plating, 72 hours; four volts, 2,500 amperes. The resulting deposit of aluminum, 2½ ounces. The next and last treatment, that in the

6. Water tank, also of wood, same dimensions as copper-acid tank, filled with clean water at about 210°, in which the article was thoroughly cleaned by immersion and stream from a hose applied repeatedly.

Eventually, to expedite the work, two more tanks were added—one acid-copper and the other aluminum. These were of plate-iron and were placed directly upon the floor in the south space near the dynamos; they were about 12 feet square and four feet deep; otherwise they were arranged like the larger tanks for the same purpose.

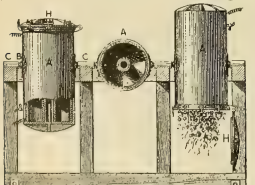
Before proceeding with the plating, the parts to be plated, after being completely fitted in place, during the preliminary erection at the works, were, upon their reception in the plating department, carefully tagged with the number and location on a sheet of brass, wired to the respective part, to which it remained attached until ready to fix in place at the building.

Upon the completion of the treatment in the alkali tank, and previous to treatment in the acid-copper tank, the article was carefully examined, and all pin-holes or other defects cleaned and filled with solder composed of tin and lead. Likewise, when the article had received its deposit of copper, it was again examined, the thick edges, which tended to form in the acid-copper tank, removed by filing, and, in the event of blisters having formed, they were cut out and the piece subjected to a second treatment for copper.

The accompanying illustration gives an interior view of this unique plating plant. One of the 1,000-pound columns is shown in the bath.

New English Decorative Lamp.

The accompanying picture shows (half size) a new type of ornamented incandescent lamp made by an English company. It is rather different from the usual forms of decorative lamps seen in this country and will interest the readers of the Western Electrician. It is interesting to note that the lamp is "guaranteed British manufacture," showing that



CARBONIZING PEAT BY ELECTRICITY.

the competition of imported lamps is a real factor in the lamp trade in England. The lampmakers of this country are eager to take advantage of any "talking point," but they do not have to guarantee American workmanship, as no other is known.

Carbonizing Peat by Electricity.

It is well known that to utilize peat to the best advantage it is first necessary to drive off the volatile portions, which consist of useless and noxious gases, and carbonize the mass. Heretofore this has been accomplished principally by means of furnaces specially constructed for the purpose, but now, M. P. Jebsen, according to la Revue Industrielle, has devised a method of accomplishing this result by means of electricity.

Upon a wooden frame mounted on rollers are arranged three swinging retorts, supported on centers C, as indicated in the cut. The left retort shows the internal arrangement; the middle one shows an end view with the cover removed; the third shows the retort being discharged.

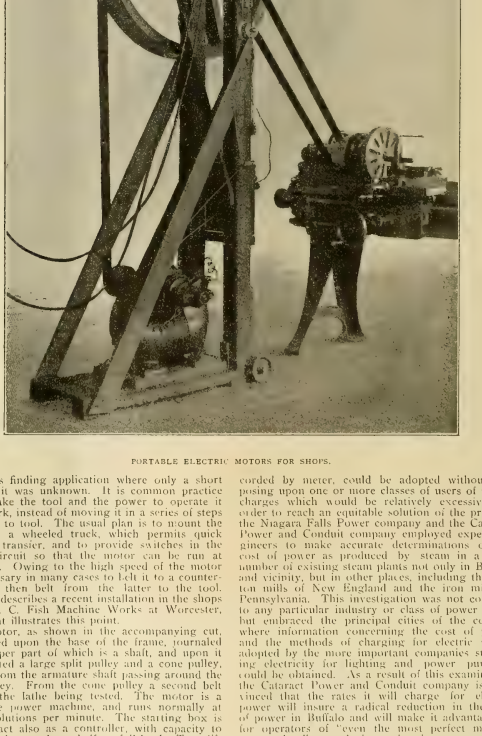
The retorts are lined with asbestos or other non-conductor of electricity and heat, which is wound spirally with an iron wire. Another winding is embedded in asbestos surrounding the core. These wires form suitable resistances for developing heat from the electricity traversing the conductors, through the terminals which are connected at the axles. Vents are established by means of stop-cocks, through which moisture and gas are permitted to escape.

The turf or peat is thus heated uniformly and thoroughly, as well as more exactly than by the method formerly employed, thus saving destructive burning and insuring a saving of 10 to 20 minutes besides.

Portable Electric Motors for Shops.

In general shop work the electric motor is recognized as a valuable factor, and in many special cases it is finding application where only a short time ago it was unknown. It is common practice now to take the tool and the power to operate it to the work, instead of moving it in a series of steps from tool to tool. The usual plan is to mount the motor on a wheeled truck, which permits quick and easy transfer, and to provide switches in the general circuit so that the motor can be run at any point. Owing to the high speed of the motor it is necessary in many cases to belt it to a countershaft and then belt from the latter to the tool. Iron Age describes a recent installation in the shops of the H. C. Fish Machine Works at Worcester, Mass., that illustrates this point.

The motor, as shown in the accompanying cut, is mounted upon the base of the frame, journaled in the upper part of which is a shaft, and upon it are mounted a large split pulley and a cone pulley, the belt from the armature shaft passing around the large pulley. From the cone pulley a second belt leads to the lathe being tested. The motor is a two horse power machine, and runs normally at 1,200 revolutions per minute. The starting box is made to act also as a controller, with capacity to cut down the speed one-half on full load. Two different sizes of cone pulleys can be used on the upper shaft, according to the size of lathe being tested. The two small wheels shown on the base of the frame, just clear of the floor, are for use when moving the device around the shop. The frame is simply tipped forward until these wheels touch the floor, when it becomes its own truck. The lighting system of the works can be tapped at any desired location, and current secured for the operation of the motor.



PORTABLE ELECTRIC MOTORS FOR SHOPS.

Cost of Niagara Power in Buffalo.

A statement of the rates at which power transmitted electrically from Niagara Falls to Buffalo shall be disposed of in the latter city has been prepared by the Cataract Power and Conduit company of Buffalo. It was found upon investigation that the requirements of the consumers and the conditions under which they operated were such as to make a uniform rate impossible. As a result of the wide range in the amounts of power which must be available and of the radical differences in hours of use, it was determined that neither the so-called flat-rate system under which each user is charged a certain amount per horse power kept at his disposal, nor the ordinary method of charging by meter under which each user pays a certain amount fixed by schedule for the actual number of kilowatt-hours or horse power hours used, as recorded by meter, could be adopted without imposing upon one or more classes of users of power charges which would be relatively excessive. In order to reach an equitable solution of the problem the Niagara Falls Power company and the Cataract Power and Conduit company employed expert engineers to make accurate determinations of the cost of power as produced by steam in a large number of existing steam plants not only in Buffalo and vicinity, but in other places, including the cotton mills of New England and the iron mills of Pennsylvania. This investigation was not confined to any particular industry or class of power users, but embraced the principal cities of the country where information concerning the cost of power and the methods of charging for electric power adopted by the more important companies supplying electricity for lighting and power purposes could be obtained. As a result of this examination the Cataract Power and Conduit company is convinced that the rates it will charge for electric power will insure a radical reduction in the cost of power in Buffalo and will make it advantageous for operators of "even the most perfect modern steam plant" to substitute electric power transmitted from Niagara for the present equipment.

Niagara power will be distributed from sub-

stations, and will be supplied in the form of three phase alternating current to all points within distances which can be conveniently reached.

Sub-station No. 1 adjoins the power house of the Buffalo Railway company, on Niagara street, and No. 2 is located on Ohio street, near Indiana street. The transforming machinery for sub-station No. 3, on Wilkinson street, is now under construction and will soon be ready to supply power.

A charge will be made for service, and, in addition thereto, there will be a distinct "charge for power." The "charge for service" is $1 per kilowatt per month (about 75 cents per horse power per month) and this will depend only upon the amount of power which the user may require the Cataract Power and Conduit company to keep available and ready for his use.

The monthly "charge for power" will depend upon the actual amount used, as determined by standard meters installed by the Conduit company upon the premises of the consumer. These meters will record the number of electrical units or kilowatt-hours actually taken by the consumer. The charge for power will be determined by the record of the meter and by calculation from the following schedule:

For use not exceeding 1,000 units, the rate shall be two cents ($.02) per unit.

For use exceeding 1,000 units, but not exceeding 2,000 units, the rate shall be: For 1,000 units two cents ($.02) per unit, and for the excess one and five-tenths cents ($.015) per unit.

For use exceeding 2,000 units, but not exceeding 3,000 units, the rate shall be: For 2,000 units one and five-tenths cents ($.015) per unit, and for the excess one and two-tenths cents ($.012) per unit.

For use exceeding 3,000 units, but not exceeding 5,000 units, the rate shall be: For 3,000 units one and two-tenths cents ($.012) per unit, and for the excess one cent ($.01) per unit.

For use exceeding 5,000 units, but not exceeding 10,000 units, the rate shall be: For 5,000 units one cent ($.01) per unit, and for the excess eight-tenths of a cent ($.008) per unit.

For use exceeding 10,000 units, but not exceeding 20,000 units, the rate shall be: For 10,000 units eight-tenths of a cent ($.008) per unit, and for the excess seventy-five hundredths of a cent ($.0075) per unit.

For use exceeding 20,000 units, but not exceeding 40,000 units, the rate shall be: For 20,000 units seventy-five hundredths of a cent ($.0075) per unit, and for the excess seven-tenths of a cent ($.007) per unit.

For use exceeding 40,000 units, but not exceeding 80,000 units, the rate shall be: For 40,000 units seven-tenths of a cent ($.007) per unit, and for the excess sixty-six hundredths of a cent ($.0066) per unit.

For use exceeding 80,000 units, the rate shall be: For 80,000 units, sixty-six hundredths of a cent ($.0066) per unit, and for the excess sixty-four hundredths of a cent ($.0064) per unit.

Pleasing Electrical Sign.

The picture given below is a reproduction of a prominent electrical sign on State street, Chicago. The sign is a particularly effective one, even on a street that is ablaze with similar advertising devices at night, as the letters have the appearance of standing out from hemispheres, although in reality the painted background is flat. It was made by the Chase Electric Sign company.

Magnetic Ore Separators.

From an early date the idea has been entertained of separating magnetic from non-magnetic substances by the use of the magnet, but up to a very recent date it had hardly been thought of to do more than separate iron from other substances, or mag

primary batteries then in use. With such sources the cost of the electric current was, however, too great to warrant a very extended use of magnetic separators, and until the invention of the dynamo machine reduced the cost of electrical energy inventors and users of such separators generally had to content themselves with such results as could be obtained by the use of permanent steel magnets.

The advent of the dynamo machine, however, gave a new impetus to the design of magnetic separators, and from 1880 to the present time a great variety of such machines have been invented, making use of electro-magnets energized by means of currents from dynamo machines.

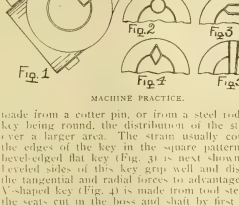
Machine Practice.

A contributor sends the following elementary explanations and simple suggestions for the benefit of such of the electrical mechanics who read the Western Electrician as are not too learned to profit by them.

Keys and Key Seats.

Keys and key seats in shafts and fittings on electrical machinery are necessarily varied in design, owing to the variety of the work performed. The common way is to sink a seat in the boss and drive in a square key, as in Fig. 1. The service performed by some of the high-speed shafts and the constant strain on the key make it impracticable to use this form. In order to avoid the liability of bursting the boss, round, V-shaped or beveled keys are often used, as shown in Figs. 2, 3 and 4.

The round key (Fig. 2) is put in by boring the boss and shaft together and driving in a round key



MACHINE PRACTICE.

made from a cotter pin, or from a steel rod. The key being round, the distribution of the strain is over a larger area. The strain usually comes at the edges of the key in the square pattern. The bevel-edged flat key (Fig. 3) is next shown. The beveled sides of this key grip well and distribute the tangential and radial forces to advantage. The V-shaped key (Fig. 4) is made from tool steel, and the seats cut in the boss and shaft by first boring round, then shaping with files. The advantage of this form of key is that the force applied is expended against the angles of the sides. The straight-

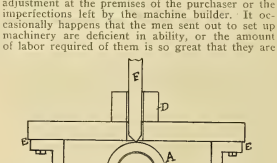
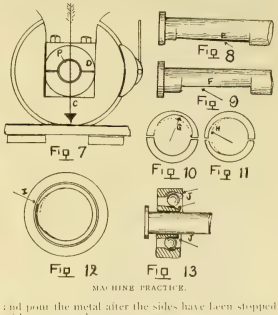


Fig. 6

MACHINE PRACTICE.

obliged to slight their work in order to turn off an amount that will be satisfactory to their employers. Then, too, the best of machinery requires care.

A shaft rests upon its bearings according to load pressure and general conditions. Say that the weight is above the center C (Fig. 7), and the wear upon the bearings is at P. The belt pressure tends, for example, to place the point of friction at about D, so that if we examine a number of shafts, we may find that they are worn at E (Fig. 8) and at F (Fig. 9). Other bearings will be seen worn as at G (Fig. 10), and at H (Fig. 11). Fig. 12 shows how the metal sleeves are sometimes worn with balls. This is shown in section in Fig. 13. The worn places are marked I in the former and J in the latter. The ring is also worn. To replace the rings with new, great care must be used in forging the blanks from which the rings are turned, to make sure that the metal is not overheated and yet shall fill the dies. A good system of ring turning is to employ two tools working together, one on the inside, the other on the outside of the flange. This insures substantial concentricity of flange. The hardening of rings is also of the utmost importance. Rings not hard enough or unevenly hardened will wear out rapidly. Rings hardened too much, that is to say, rings hardened at either too high a degree of temperature, or exposed to heat for too long a time, become changed in character, the metal becoming granulous and rotten, and the surface becoming glassy and non-effective. As to the babbitting of the worn shafts and sleeves, first clean off all foreign matter and build up the shaft to its proper place in the box, by means of blocks on the outside,



MACHINE PRACTICE.

and pour the metal after the sides have been stopped with putty or clay.

Adjusting Circuit Breakers.

See that the latches of the dial needles are perfectly covered by the guide; if they are not it shows that the cam is throwing them out too far. To overcome this, remove the cam from the dial and take a little off the point that pushes the needles to their farthest point. If this cam is put in there will not be much trouble with breaking of needles or dial slots. Set the cam in dial just far enough so as to allow the needle to clear itself. If the latch does not close tight enough there may be dirt or dust under it. If there is, it may be removed by a piece of fine wire sharpened at the end. Use nothing but good oil on cylinder and dial, so as to keep them from getting hotted or rough. Common machinery oil will soon ruin them and make them a constant worriment to the one who has them in charge.

PLEASING ELECTRICAL SIGN.

nesite and perhaps pyrrhotite from other ores. The magnet has been used for separating iron chips and turnings from the brass chips collected in shops where both metals are worked together. Special magnetic separators have been devised for the separation of iron from rags used for making paper and for separating from paper pulp the finely divided iron that is ground up with the rags in the paper engine or that comes from the wear of the engines themselves.

Numerous magnetic separators have also been devised for separating magnetite from other ores or from other substances with which it is often found associated, and descriptions of such machines in which electro-magnets were used will be found among the patents granted nearly 50 years ago, when the only source of the electric current were the

through key in Fig. 5 is serviceable in certain cases in which the work is moderate and the speed not high.

Drilling and Slotting.

Fig. 6 shows a device for drilling and slotting key seats and pins of the type shown in Fig. 5. The piece A to be drilled is adjusted on the bevel pieces C C. The latter pieces can be adjusted to a center by means of the screws. Top adjusting screws E E allow the drilling tool guide F to be set as desired. Any mechanic can make one of these devices.

Worn Bearings.

The writer is aware that many things have to be done with old machinery that would be utterly impracticable on new. Yet it may be proper and necessary, under the circumstances, in order to get good work. The bearings should have careful attention. But before adjusting and overhauling the bearings, see that the machine is set up so that the different parts are fitted properly, made level and plumb, especially such parts as relate to the most vital parts, and particularly when running at high speed. Manufacturers of electrical machinery are blamed sometimes for faulty design when the trouble is wholly with the machine, either in the adjustment at the premises of the purchaser or the imperfections left by the machine builder. It occasionally happens that the men sent out to set up machinery are deficient in ability, or the amount of labor required of them is so great that they are

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State of Illinois, County of Cook—ss.

Frank Foster Kenworthy being duly sworn deposes and says that he is president of the city of Chicago, in the county of Cook and state of Illinois, and that he is the superintendent of the binding department of the Electrician Publishing company, the publishers of the Western Electrician; that he was present at and superintended the binding of No. 24 of Vol. 20 of the Western Electrician, issued on June 12, 1897, and that there were sent out by actual count 20,000 complete copies of said Western Electrician of the volume and number above specified.

And further this affiant sayeth not.

FRANK FOSTER KENWORTHY.

Subscribed and sworn to before me this 27th day of July, 1897.
Chicago, July 27, 1897. IRA B. JONES, Notary Public.

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To most of the men engaged in the electrical industries in this country, war is, fortunately, a new experience. Nevertheless there will be no attempt to evade its responsibilities or to shirk the supreme duties of citizenship, which, in the last analysis, must override all purely private or selfish considerations. The war is a just one and it will be supported by a united country; men of all sections, all industries, all shades of opinion in other matters, will uphold the hands of the government. In this patriotic duty it is certain that the electrical fraternity will be most earnest and active. To such assistance as it can give, the Western Electrician pledges itself, and it will also endeavor to give some account of the applications of electricity in warfare as they are subjected to the grim test of service.

While it would be foolish to underestimate the serious nature of the campaign in which the United States has engaged and its effect on business enterprises, we think that if all survey the situation calmly and carefully balance the probabilities of actual hostilities there need be little disturbance of present industrial conditions. The military and naval operations should be pushed with all rapidity compatible with prudence. We trust the war will be short, sharp and decisive, and do not anticipate that the demand for electrical products, for instance, in this great country of 70,000,000 people will be seriously curtailed. As the New York Commercial said in a thoughful editorial printed a few days ago, "There is no danger of financial stringency or a disorganization of commercial confidence. Most of the fears which induce ultraconservatism are groundless. The idea that Spain can seriously injure American commerce is an exaggerated one. A little demonstration will convince people that they have overestimated the effects of hostilities, and if Spain should stick to its policy of resisting the inevitable and war is the only cure for its infatuation, it will be the real and only sufferer."

We find in the Iron and Coal Trades Review of London of recent date a brief description of the artificial moon in the reading room of the "Columbia (U. S.) State Library." Now, we would like to know what our New York friends think of that.

An excellent idea of the telephone situation in Great Britain can be gained from a perusal of the report of the discussion of the subject in the House of Commons, April 1st, which is presented in another place this week. The English method of handling this subject will be followed with interest by telephone men in this country. It is probable that upon the expiration of the present franchises the monopoly will be terminated or transferred to the government.

Attention is directed to "the arc as a telephone" by E. E. Fournier d' Albe, in the London Electrician. He explains that if the circuit of an arc lamp happens to be close to another circuit traversed by feeble intermittent currents, the arc emits a loud rattling noise. The intermittent currents may be produced by a tuning-fork interrupter, or by the hammer of a small induction coil. They produce in the arc circuit intermittent induced currents, and the latter affect the temperature of the arc and produce the noise. That the noise is due to the arc itself, and not to the regulating mechanism, is proved by the fact that the sound is heard equally clearly when the carbons are a fixed distance apart.

The phenomenon was discovered by H. T. Simon, who attempted to obtain a photographic record of the flickering of the arc, but failed because the changes of brightness are too slight in comparison with the total brightness. On placing a microphone in the primary circuit, the note of a tuning-fork and the sounds of whistling, tapping and singing were reproduced by the arc, with every detail of intensity, pitch and quality. Experiments made with a shunt circuit showed that the quantity of electricity capable of producing an audible sound was 5×10^{-6} coulombs, corresponding to a change of temperature of 0.3°C. Sound waves acting upon the arc direct produced changes of density and fluctuations of the current, which could be transmitted to a distance and reproduced by a telephone at the other end. Further investigations are now being conducted.

Occasionally the advocates of municipal ownership of quasi-public enterprises are confronted with the old-fashioned idea that public funds should not be devoted to any business that could be conducted by private capital, and that it is only where public safety or public health is concerned that governments are justified in exercising their power of control. An instance of this kind is presented in the case of "Mayo against the town of Washington," a municipal corporation containing a population of 5,000 inhabitants. The Supreme Court of North Carolina last month decreed that the purchase of an electric-light plant for the town, at the price of $20,000, simply to light its streets, was not a "necessary expense" pertaining to its government. The power to establish electric-light plants and waterwork plants, the court explains, stands on substantially the same footing. The importance of the decision will be appreciated when taken in connection with the provision of the constitution of the state which prohibits municipal corporations from contracting debts or levying taxes, except for necessary expenses, unless by a majority vote of the qualified voters of the corporation. The decision is significant, too, on account of the high standing of the court.

If the owner of a patent applies to the Patent Office for a reissue of it, and includes among the claims in the application the same claims as those which were included in the old patent, and the primary examiner rejects some of such claims for want of patentable novelty, by reference to prior patents, and allows others, both old and new, does the owner of the patent, by taking no appeal and by abandoning his application for reissue, hold the original patent, the return of which he procures from the Patent Office, invalidated as to those of its claims which were disallowed for want of patentable novelty by the primary examiner in the proceeding for reissue?

This question was raised in the United States Circuit Court of Appeals during the hearing of arguments in the case of the McCormick Harvesting Machinery company against C. Aultman & Co., and because of its vital importance was immediately certified to the Supreme Court of the United States for consideration and final adjudication. The latter tribunal has handed down its decision, which answers the question propounded most emphatically in the negative, and supports its position by an unusually interesting opinion.

The court says that it has been settled by its repeated decisions that when a patent has received the signature of the secretary of the interior, countersigned by the commissioner of patents, and has had affixed to it the seal of the Patent Office, it has passed beyond the control and jurisdiction of that office and is not subject to be revoked or canceled by the president or any other officer of the government. It has become the property of the patentee and as such is entitled to the same legal protection as other property. The only authority competent to set a patent aside or to annul it or to correct it for any reason whatever is vested in the courts of the United States, and not in the department which issued the patent. In this respect a patent for an invention stands in the same position and is subject to the same limitations as a patent for a grant of land. Moreover, while an original patent for an invention, if found inoperative or invalid by reason of a defective or insufficient specification or because too much has inadvertently been claimed as new, may be surrendered and a reissue may be granted, the Supreme Court says that such surrender takes effect only upon the issue of the amended patent. Upon application being made for a reissue, it says that the Patent Office was authorized to deal with all the claims, the originals as well as those inserted first in the application, and might declare them to be invalid, but such action would not affect the claims of the original patent, which remained in full force, if the application for a reissue were rejected or abandoned. This decision settles an important point in patent law which has long been in dispute and which has at some time been brought up in the experience of every inventor who has had much to do with the Patent Office.

WAR NEWS.

Congress transmitted a joint resolution on April 19th recognizing the rightful independence of the people of Cuba and demanding that Spain evacuate the island, at the same time directing the president to use the army and navy to carry the resolution into effect. On the following day the president signed this resolution, thus making it a law, and also sent an ultimatum to Spain. This action is tantamount to a declaration of war.

Harbor Defense.—The work of protecting the harbors of the Atlantic coast by mines, torpedoes and searchlights to be electrically operated, and of providing means of electrical communication between forts and other coast defenses, proceeds with great vigor, as shown by the reports from Boston, New York, Fort Monroe, Savannah, Charleston, New Orleans and other places. Captain Allen, the chief signal officer in New York harbor, is reported as saying that the wire needed for equipping the range-finders and position-finders at the various forts has nearly all been put in place and that the cable connections are practically completed. From Fort Monroe comes a rather curious story of the utilization of an old invention. It is said that a type of circuit-closer invented by Frederick G. Kipper, a private at the post, 12 years ago, was adopted for use in connection with the electrical circuits to be used in firing the submarine mines in Hampton Roads. The invention has been stowed away in the fort for 10 years, and has now been selected as the most ingenious and simplest of 12 devices. The engineers at this fort are actively preparing to have the submarine mines all ready to plant in Hampton Roads just as soon as war is declared.

A correspondent of a New York paper makes the unique but impracticable suggestion that the United States might countermine Cuban harbors—that is, plant mines and torpedoes outside of the Cuban mines and thus prevent the ingress or egress of Spanish war vessels. All that is needed, he says, is "the electric spark and a long cable" after the torpedoes or mines are placed.

From the very nature of the operations, very few persons—military men, electricians or others—are familiar with the exact method pursued in laying down submarine mines or torpedoes to be electrically fired from the shore to destroy a hostile ship. The New York Sun of recent date published a readable article on the subject, and although, judging by the electrical part of it, it can hardly be accepted as authoritative, still it contains many statements of general interest. A portion is quoted:

Mines for obstructing the approaches of an important position will be disposed upon one or more of four systems—grand groups, skirmish lines, detached groups and self-acting mines. The last absolutely close the approach to a harbor or channel to all ships; the others offer a safe passage to friends, either through a narrow unobstructed lane, or, with certain precautions, over the mines themselves. As for mines now being planted in the Narrows and at Sandy Hook, the general plan is to have a skirmish line for the exterior obstruction. This is arranged as follows: A large loop of single-conductor cable is laid with both ends in the mining casemate, from which every mine in the system is fired. This main cable is tapped every 250 feet, and a short cable leads from each of these points to a mine, usually 100 feet away to the front. The mine thus planted is fired by the contact of the enemy's ship with the torpedo. The electric current is always on, and the circuit is completed by the contact with the enemy's ship, causing the explosion. This system bears the same relation to the regular grand groups that a skirmish line of soldiers does to a line of battle. It increases the number of mines in a channel at comparatively slight expense, and, moreover, extends the area of danger to the hostile ships throughout a wide zone in front. By its use the enemy is forced to take precautionary measures a long distance from the defended fort in front of the principal lines of defense. The cost of a skirmish line in ordinary channels is about $6,000.

A grand group contains 21 mines, separated from each other by spaces of 100 feet and covers a front of 700 yards. All of these mines are operated through a seven core multiple cable, each core being connected with three mines through a water-tight insulated chamber. When set for automatic firing, only the mine struck by the enemy's ship explodes. The mines on each core may, if occasion arise, be fired simultaneously. Skilled engineer soldiers can lay a grand group in about 13 hours. From the mining casemate, which is usually near the level of low water, yet sheltered from bombardment as much as possible, the seven-stranded multiple cable extends to a grand junction box. Here the cores diverge as seven single-conductor cables, radiating like the ribs of a fan toward the enemy. These branch cables terminate in triple junction boxes 300 feet apart. At each of these points the cable again radiates through a water-tight insulated three-chambered receptacle, called a cut-out box, into three single-conductor cables, each terminating in a mine, which is a 500-pound ground mine, if the harbor or channel depth is less than [illegible] feet, or a bouyant mine of half that weight if there is a greater depth. In the latter case a buoy should mark the position of the explosive bulb, whose submergence is regulated by an anchor. Two of these mines are planted on the line of the triple junction boxes and one in front of it toward the enemy. The total cost of a grand group for service varies with the depth of the water and the strength of the current from $6,000 to $9,000, adding about $1,600 a mile for the multiple seven-stranded cable required between the group and the mining casemate. From this place every mine may be fired by turning the proper switches upon a switch or operating board to which all the torpedo cables run. At the proper time the man on the lookout for hostile ships telephones to the casemate, and the electric spark is sent upon its deadly mission at the proper moment. Detached groups and self-acting mines explain themselves by their names. The cost of one mine of the latter class is $250.

The work of mining with dynamite torpedoes the channel between Fort Schuyler and Willets Point began last Thursday [April 7th]. The flotilla used for the work consists of a steam tug with a crew consisting of one non-commissioned officer of engineers, one private, an engine driver and a steersman, one grand junction box boat with crew, and three triple-junction box boats and crews. One of the smaller boats accompanies the tug in laying the multiple cables as soon as the position of the grand-junction box has been located. This is done by placing the boat at the intersection of the axes of two theodolites, whose position is taken from an engineer map of the harbor or channel to be mined. The triple-junction boxes are then laid, and finally, after the necessary soundings have been taken, the mines are dropped at the proper measured distances from these last boxes and the connections are made from the box through a well-insulated cable.

Linemen of the Western Union Telegraph company are connecting the life-saving stations along the Long Island coast with the fortifications on Long Island and with Governor's Island. Connections will also be made with the Brooklyn navy yard. One object for making these connections is to enable the commanders of the scout boats that are to patrol the Long Island coast to make quick reports to the nearest army and navy headquarters.

Capt. Caspar F. Goodrich of the navy has perfected all arrangements for the new signal system by which quick and accurate communication can be carried on between vessels and shore stations. The entire coast line, from Maine south, has been divided into signal districts, nearly corresponding to the present lighthouse districts, with headquarters of the general superintendent in New York city. The first district comprises the entire New England coast and includes these light stations: Monhegan Island, Maine; Cape Elizabeth, Maine; Appledore Island, New Hampshire; Cape Ann, Cape Cod, Gay Head and Block Island. The second district, with headquarters on the receiving ship New Hampshire, in New York city, includes the light stations at Montauk Point and Iquoque, Long Island; Fire Island, Barnegat, N. J., and Cape Henlopen, Del. The third district will have headquarters at Norfolk, from which orders will be given for the conduct of the stations, which are at the lighthouses at Cape Henry, Point Lookout and Cape Fear. The fourth district will have headquarters at Charleston, S. C., and includes these stations: Charleston, Hilton Head, Tybee Island, and South Simons Island. The fifth district will have headquarters at Jacksonville, Fla., the first station being at the mouth of the St. Johns River, the next at Cape Carnavaral, then Jupiter Inlet and Miami. The sixth district will be at Tampa, and will include stations all around the southern Florida coast. From Florida to Louisiana will be another district. The semaphores and signal equipment have all been secured and are ready for distribution.

Status of Military Telegraphers.—Representative Belknap of Chicago is credited with the desire to give proper recognition to the telegraphers who may serve in the war that seems inevitable. He has a plan for organizing the telegraph branch of the military service into an officered department, having rank and prestige with the medical corps. For years, as is truthfully stated by a writer in the Chicago Record, it has been the grief of the old-time military telegraphers who served in the civil war that after hostilities ended they were sent back to civil life with no recognition whatever of their difficult and perilous work. They were regarded simply as civilian hired men, and, although what they did was of far more importance than many actions which brought promotion and honors to officers, nobody ever heard of it. The ordinary pension rules did not apply to them, and do not to this day, for they have never been given military status. The old operators for years have chafed under this state of things, and now that army fighting appears imminent once again, the younger generation of telegraphers is likewise interested. Mr. Belknap, expressing hearty sympathy with the matter, has taken the question before the committee on military affairs, of which he is a member, and, although the present situation makes such a measure improper of entertainment, it will be called forward as soon as an actual condition of war exists.

Submarine Torpedo Boats.—A particularly successful trial of the submarine boat Holland was made on Saturday last near Perth Amboy, N. J. The Holland went down until there was between three and four fathoms of water over its deck, and then for 12 minutes scudded along at full speed, nearly 10 knots an hour. The boat made three dives, and when the inventor came to the surface after the last one he declared himself better satisfied than ever that his submarine boat is a success. Part of the time the Holland was under water it was scraping bottom, and the pressure gauge in its conning tower showed that at times that there was fully 25 feet of water over its tower.

The submarine boat Plunger, also of the Holland type, building at the Columbian Iron Works, in Baltimore, is about ready for her sea trial. It has been said that she was only about 60 per cent. completed, but the officials of the Columbian company assert that it remains necessary only to overhaul her gas-fuel engines, a matter of a day or two, to render the boat ready for service.

These boats are operated by gas engines on the surface and storage batteries when submerged. They are equipped with compressed-air guns to discharge dynamite projectiles or torpedoes either above or below the surface of the water.

Observation Balloon.—A large observation balloon has been sent from Fort Logan, Colo., to New York, to be used in case hostilities are begun. It is 40 feet in diameter and takes 14,000 cubic feet of gas. It will be securely anchored to the ground and its maximum ascension will be about 1,800 feet. This is supposed to give a visual range of 150 miles. It would not be likely to be noticed by an enemy until he was within a few miles, for it forms a very small speck on the sky-line, when seen at any considerable distance, and even quite close at hand the enemy could hardly interfere with it, as modern armament is not built with a view to aerial gunnery. The balloon will be connected with the ground by telephone and supplied with searchlights and special observation glasses of great power. Should a Spanish fleet appear anywhere off the near-by coast, the first discovery would probably be from the balloon.

Floating Machine Shop for the Navy.—The Navy Department has purchased the ship Juniata, which will be converted into a repair ship and assigned to the North Atlantic fleet or the flying squadron. This is one of the precautions for which Engineer-in-chief Melville has contended for some time. A similar ship was equipped during the Chilean excitement. The Juniata is well adapted for this purpose. She is a steel vessel and will be fitted out with about $30,000 worth of tools and machinery. The work of equipment will be done at the Boston navy yard, where orders have been sent to accumulate the material needed. The ship will be commanded by an engineer officer, with four assistants, and volunteer naval officers will fill the places of executive and watch officers. The enlisted force will consist mainly of machinists and electricians. The Juniata will be prepared to repair any damage which may happen to the machinery of a vessel, also material external damages.

Miscellaneous Notes.—Lieut. S. D. Flood of the Northern Illinois batallion of naval militia, who has been an active figure in recruiting and drilling men for his division, is well known to electrical men, as he was for several years connected with the power and mining departments of the Thomson-Houston and General Electric companies.

The great activity at the Brooklyn navy yard has caused the officers in charge to make a recommendation that the electric-lighting facilities of the reservation be increased materially, so that night work about the yard and the drydocks may go on without being hampered. Some time ago plans were prepared for enlarging the illuminating plant, but there has been some delay (not an unusual occurrence at the yard) in securing a building of the Department of Construction and Repair large enough to accommodate the increased plant. As the building to which the plant will be transferred will not be vacant until July 1st, Civil Engineer Endicott of the Yards and Docks Bureau has recommended the allotment of $30,000 for the immediate construction of a temporary building for the purpose.

Apropos of the article on West Indian cables in the Western Electrician last week, it is interesting to note the dispatch from Madrid, printed in the American papers of April 18th, stating that Senor Moret, secretary of the colonies, has approved a contract to lay a direct cable between Cadiz and Havana, by way of Teneriffe and Vieque (Crab Island), nine miles east of Porto Rico. It is, of course, to be remarked that in all human probability this cable will never be laid.

One feature of the proposed war-tax revenue bill is a tax of one cent on every 25-cent telegraph message.

Prof. R. H. Thurston, director of Sibley College, Cornell University, is an engineer whose opinion carries weight. He has carefully examined the report of the Maine Board of Inquiry and asserts that it gives "proof, positive and absolute," of the facts that the ship was destroyed by an "exterior explosion," that it must have been that of a mine, and at the port side of the vessel, near the bow; that only an exceptionally heavy charge could have performed the destructive work; that such a mine could only have been set by expert military or naval engineer or ordnance officers. It could, therefore, he says, have been fired only by men officially connected with but not authorized by the Spanish government, and thus the case of the United States is made absolutely unchallengeable. He asserts that it is a duty on the part of all members of the engineering profession to examine these proofs as presented in that report, and the more so as they, next to naval and military men, will necessarily direct public opinion in relation to the responsibility.

A number of Chicago electrical men have already signified their intention of joining the volunteers as soon as the president calls for troops.

The students of the electrical engineering department of Purdue University, Lafayette, Ind., are to be especially favored this spring in the matter of visitors who will address them along professional lines. Prominent among the list of the non-resident lecturers at the university are the names of Samuel Insull and Albion E. Lang, who have already done much to advance the electrical interests of the country, and who stand at present among the most advanced thinkers and workers of America. Mr. Lang, who is president of the Toledo Traction company and of the American Street Railway association, will deliver an address at the university on the subject of "Electric Power Companies and Their Relation to Municipalities" on April 26th. Mr. Insull is president of the Chicago Edison company, of the National Electric Light Association and of the Association of Edison Illuminating companies. He will visit the university on May 17th, and will lecture on the subject of "The Development of the Central Station."

DEVELOPMENT OF THE TELEPHONE FIELD.

Massachusetts Telephone Bill Killed.

[Special correspondence of the Western Electrician.]

Boston, April 17.—The bill to place telephone companies in Massachusetts under state supervision, the full text of which was printed in the Western Electrician of April 9th, has been killed by the lower branch of the Legislature, where the bill originated. It passed several readings by a close vote, the question on ordering to a third reading being voted on April 1st, when the friends of the bill won by a vote of 75 to 61, with enough pairs recorded to place on record 200 of the 240 members of the House. On April 12th, on the question of ordering the bill to be engrossed, the opponents of the bill were victorious by a vote of 84 to 77, with sufficient pairs to place 209 members on record. The following day reconsideration was refused by a vote of 105 to 78.

The Massachusetts Legislature thus places itself in the position of taking a right-about-face on an anti-corporation measure. There seems to be no doubt that the Bell and New England companies used all the influence they possesed to defeat the bill. Representative Mead of Lexington said in debate on the floor of the House that the lobby employed against the bill was "the largest and most unscrupulous since the Bell telephone grab" several years ago. A survey of the corridors of the state house, while the bill was under discussion, would have led the observer to believe that the statement had some foundation in fact. The bill was a so-called popular measure, but its popularity with the people failed to overcome the powerful influence of the telephone interests.

The bill would probably have met its death in the Senate any way, but the action of the House is no less a disappointment.

An examination of the record reveals the significant fact that on the final roll-call members who had been recorded for the bill at previous readings or had been paired in favor of it either changed their votes or stayed away, in a sufficient number to defeat the measure.

Southern Telephone Notes.

The Knoxville, Tenn., Sentinel of April 12th contains the following paragraph: "Last week when Cattlet Tipton was placed in jail at Sevierville after he had been committed there by the jury who pronounced him guilty of the murder of William Whaley, there was a scene that was partly transmitted by the People's Telephone company to this city. Tipton was placed in a cell and afterward his wife was shown to his cell. Then began a crying spell of the wife and husband. So violent was the sobbing that it could be heard in the courtroom, 200 feet away, and disturbed the court. The position of the wife and husband was such that the sound had to travel to reach the telephone in a Z-shape course a distance of 50 feet. The telephone at the jail is connected with the exchange there, and there is 30 miles of wire between Sevierville and the exchange in this city. The sobbing of the wife and husband, as well as their words, could be heard in this city."

The People's Telephone and Telegraph company of Knoxville has just issued a directory of its local exchange subscribers and those of the independent companies in Maryville, Newport, Morristown, Greenville, Rogersville, Sevierville, Johnson City, Coal Creek, Trotters, Elizabethton, Jonesboro and Clinton. The company's stockholders are representative merchants and business men of Knoxville. The charge for service among twice as many patrons is less than one-half the former average price. The company asks its patrons to note the contrast in telephone facilities before this enterprise started with those of the present. The rates are 50 per cent. less, the service 100 per cent. better, the number of subscribers increased 400 per cent. and toll-line connections furnished with all East Tennessee. The offices and exchange are in the City National Bank building. The operating room and the details of the system employed have been described and illustrated in the Western Electrician. The officers are the following-named gentlemen: President, C. E. Lucky; vice-president, W. L. Welcker; general manager, J. C. Duncan; secretary and treasurer, Elmer D. Ross. The board of directors is composed of C. E. Lucky, W. L. Welcker, M. L. Ross, J. C. Duncan, Asa Hazen, E. G. Oates and A. J. Douglas.

Independent Movement in Lancaster County, Pa.

The independent telephone movement is making rapid strides in Lancaster County, Pennsylvania, where the Columbia Telephone company began business on January 1st. The initial exchange equipment comprised a 100-point switchboard. The company started with 50 subscribers connected, and since that time it has doubled the capacity of the exchange, and it has also increased its service to 150 subscribers' stations connected in Columbia. A pole line has been built to Marietta, and an exchange put in with one 50 point board, which opens up communication with Chick[illegible], Watts and Maytown. Work was begun on Monday, April 18th, on an extension of the line to Mountville, Lancaster County, and will be completed about May 1st. The Columbia company has also been granted franchises to build lines in Mount Joy, Elizabethtown, Lititz, Epraha, and these towns will be equipped with first-class exchanges and pole lines soon.

The switchboards and telephones to be used will be supplied by the Western Telephone Construction company of Chicago. The Columbia company has met with success since it has been in business, and is gradually driving the Bell people out of the towns on its lines. The managers of the York County Telephone company and Columbia company are to meet on April 20th and complete arrangements to connect their systems and adjust toll-line rates, which will add greatly to the strength of both companies. The officers and directors of the Columbia company are: President, H. C. Young; secretary, F. G. Pain; treasurer, Charles Rochow; superintendent, H. W. Johnson; William Mattern and M. R. Hoffman.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

C. G. Cockerill of Jefferson, Ia., has secured entire control of the Jefferson Telephone company, including toll and local-exchange lines. Mr. Bandy, heretofore a partner, now holds the lines south of Jefferson only. Mr. Cockerill is planning extensions to Grand Junction and other points.

The Canton, S. D., Telephone Exchange company has been incorporated to put in a local exchange. A line will be run to Moe, Alcester and Beresford.

Alfred Sundeen has made a proposition to put in a telephone exchange for Princeton, Minn.

The electric-light company at Knoxville, Ia., was granted a franchise for a telephone exchange.

The Iowa Mutual Telephone company has been refused an exclusive telephone franchise at Atlantic, Ia. Pat Boyle of Massena also asked for a franchise for a company which will build from Corning to Atlantic.

The Iowa Telephone company is working to put in an exchange at Villisca, Ia.

A local telephone exchange is proposed at Benson, Minn., and a stock company will be formed.

A telephone is in prospect at Cantril, Ia., to Memphis, Mo.

The Watterson, Ringgold and Caledonia Telephone company has been incorporated at Mount Ayr, Ia., and proposes to build to Hatfield, Mo. The poles are all set for the line between Watterson, Ringgold and Caledonia.

The American Telephone and Telegraph company celebrated its long-distance connection with La Crosse, Wis., by giving subscribers there a free concert over its lines, the music coming from a band in Milwaukee.

Rowe Brothers have the poles set for 40 miles on the line between Pierre, S. D., and Rapid City, and the holes are dug almost to Rapid City. They will begin stringing wire soon.

A Des Moines company has arranged to give long-distance connection for Cottonwood, Minn.

The New Ulm Telephone company of New Ulm, Minn., is preparing to build lines to Mankato, Evan, Morgan and Redwood Falls.

Fairhaven, Wash., is promised night service if 50 subscribers can be secured.

The Marshall-Wells Hardware company at Duluth, Minn., has just had a private branch-telephone exchange put in its building, with 20 instruments.

The Iowa Telephone company proposes a line from Cherokee to Primghar.

The towns of Humeston and Allerton, Ia., have both voted franchises for local telephone companies.

A telephone line is projected between Red Lake Falls, Minn., and Chester.

Arrangements are completed for putting in a telephone exchange at Eureka, S. D., at once.

W. K. Hind of Fairfield will succeed C. W. Bartlett as manager of the Mutual Telephone company at Des Moines. The Mutual company has 10,000 feet of cable being constructed to improve its service. The company is also interested in the new company which has been formed to build lines from Des Moines to Ottumwa, to include connection with Newton and Oskaloosa. Its office at Des Moines is to be enlarged, and operators are to have only 75 instead of 100 instruments to answer.

The Iowa Telephone company will construct about 900 miles of new toll lines, all to be metallic circuits, this year. The longest will be from Davenport to Des Moines, via Washington, Oskaloosa and Indianola, 222 miles. The next longest will be from Dubuque to Fort Dodge, 202 miles.

The Sparta Telephone company of Sparta, Wis., will extend its lines to connect with La Crosse, via Cashton and with Norwalk.

George Pfefferkorn has arranged to have work begun soon on the local telephone exchange at St. Charles, Minn.

An ordinance granting the American Telephone and Telegraph company a franchise in Duluth, Minn., has been introduced in the council. It provides against consolidation with any existing company, but has the right to use the subways, wires and poles of other companies. The council and mayor propose to hold off from granting any franchises until the new charter is in effect, if possible. At the same time the city wants long distance connection. The fear of the council is that in some way a franchise to the long-distance company will be used to extend the present company's franchise, which expires in 1899. Under the new charter the people will vote on all such franchises.

The Plainview, Minn., Telephone company will put in a metallic circuit between Hammond and Wabasha and buy a new switchboard.

The Woodbine Telephone company of Woodbine, Ia., will extend its lines soon. It expects to build about 50 miles of new wire this season.

The Union Electric Telephone company of Waucoma, Ia., proposes to build from Austin, Minn., to Albert Lea.

Cheaper Telephones Needed.

[From the New York Tribune.]

The annual meeting of the Bell Telephone company was held in Boston recently, and in his address the president declared that the output of telephones and the increase in the number of exchange subscribers was unprecedented in the business. He added that the gains in the pay stations in the last two years were equal to the aggregate gains of the six preceding years. The figures of the annual report showed a condition of marvelous prosperity. The total income for the year was $5,130,844, while the total income in 1896 was $4,327,324. An extremely large proportion of the income was clear profit, for the annual report states that the net income in 1897 was $4,169,674, and that dividends were paid for 1897 amounting to $3,682,948. The balance-sheet on December 31, 1897, showed total assets of $60,779,841. It also showed a reserve of $4,025,628, in addition to the surplus of $2,590,521.

It is evident from these statements and these figures that the Bell Telephone company has been one of the most gainful corporations ever organized in this country. Its proportion of clear profits to expenditures has been exceedingly impressive. When the telephone subscribers in New York reflect upon these figures they cannot fail to be unhappy, because they are still required to pay such large sums for telephone service. Not only are the rentals of telephones in this city plainly excessive in proportion to the genuine merits of the service given, but when any telephone subscriber in the borough of Manhattan wishes to talk to a subscriber in the borough of Brooklyn, in the borough of Richmond, or to a subscriber in any part of our suburbs, including Jersey City and other New Jersey places, an extra charge is imposed. People who are familiar with the actual amounts paid for telephone service in the borough of Manhattan must feel that they are paying too much for what they get. It is not intended to intimate that the profits of the company which owns the telephones in this borough or of the companies which control the telephone service in the vicinity of this borough are anything like so huge as the vast profits of the Bell Telephone company itself. When the users of the telephone all over the United States study the figures of the annual report of the Bell company, and when they inform themselves as to the low rates for telephone service in England and on the continent of Europe, it will not be surprising if they become impatient and restless because Americans are required to pay so much more in proportion for telephone communications than subscribers are compelled to pay in England and on the continent. The reduction of telephone charges has been fought at Albany and other state capitals with conspicuous ability, ingenuity and stubbornness. The unhappy subscribers of the borough of Manhattan are not likely to get service at reasonable rates until an agitation has been entered upon so active and so energetic that the Legislature will not venture to refuse a reduction.

It would be a gracious and generous act if the men in control of the corporations which own the telephones in this state and in other states would recognize the obvious fact that they have already made splendid profits out of the telephone monopoly, and that it is time for them to be more liberal and benevolent in their treatment of telephone subscribers and of the American people generally. Since the telephone first came into use the cost of travel in our cities and our communities generally has been much diminished. Consider the system of transfers on many surface lines in all the boroughs of this city and in many other cities, and it cannot be denied that in most of the important cities, town and villages of the country people now have ample opportunities for riding many miles in cable cars or in electric cars for low rates of fare. The tendency has been for years to give the public larger returns for moderate expenditure in many matters. Many kinds of clothing and many kinds of food can be bought much more cheaply than a few years ago. The charges for telegraph messages have been cut down a great deal since the telephone was invented. Officers of the local telephone company insist that their system supplies so many calls for the money paid that they are not making objectionable profits. But when the annual report of the Bell company sets forth the prodigious gains of that corporation the telephone subscribers in the borough of Manhattan cannot be convinced that the local telephone company is earning only fair and equitable profits on the amount of capital actually and honestly invested. New Yorkers are paying too much for telephone service, and the next Legislature should cut the rates sharply.

Telephone Situation in England.

The controversy over the telephone service in Great Britain has reached the stage where the House of Commons has taken notice of it. On April 1st the following resolution was introduced:

That the continued refusal of the Postoffice to grant licenses to and allow municipal corporations and other responsible bodies to compete with the National Telephone company is contrary to the Treasury minute of May 23, 1892, is inconsistent with the letter and spirit of the agreement entered into with the telephone companies when the Postoffice took over the trunk lines, and is calculated to prevent the establishment of a cheap, adequate and efficient telephone service in the United Kingdom, and to increase the difficulties and costliness of any arrangement for the assumption by the state of the whole telephone systems, should that step ultimately be considered desirable.

The debate lasted four hours and was devoted principally to the history of the development of the telephone service in Great Britain. Mr. Caldwell, who introduced the resolution, said that it was generally recognized that the subject was one of national and local interest and importance and one outside of party politics. He reminded the House that the Postoffice granted a license to the United Telephone company authorizing it to erect and work telephone exchanges in London within a radius of five miles from a central point to be fixed by the company, the royalty charged in all cases being 10 per cent. of the gross earnings. The United Telephone company confined its own exchange operations to London, but it allowed its apparatus to be used in other parts of the country by subsidiary companies. These subsidiary companies were left to negotiate with the Postoffice for a license. The licenses granted were all made to expire on December 31, 1911. At the date named, therefore, all telephone licenses would lapse and the state would then be free to assume the sole right of working the telephones. Until 1884 telephone licenses were restricted to towns and areas within a certain radius of towns. The Postoffice offered to supply trunk lines connecting towns on condition that the users should pay the department direct. This offer was not accepted, but in a few cases, as between London and Brighton, trunk wires were provided for the use of the telephone companies at a fixed annual rent. In all about 23 licenses were granted for telephone use in these restricted areas. In 1884 licenses, instead of being limited to a restricted area, were made to apply to every part of the United Kingdom, and included the right to erect and work trunk lines. The new licenses were granted to the original holders; but while the policy of the Postoffice was to increase the number of licenses and to encourage competition, the policy of the telephone companies was to buy up competing companies at almost any price, with the view of establishing a private monopoly. The amalgamation of the telephone companies then took place, and the probable effect did not escape the attention of the postmaster-general. Mr. Fawcett said that he was pressed on all sides not to allow a private monopoly to grow up and to be vested in a private company, and the policy of Mr. Fawcett continued to be the policy of his successor. The Treasury minute of May 23, 1892, restricted the granting of licenses to responsible companies who had the consent of a municipal authority, and who were not so likely to apply for a license merely in order to sell it to the National or other telephone company. But the interposition of the municipal authority in an application for a license was a very limited safeguard, and would not, unless the license was carefully restricted, prevent the National Telephone company from afterwards buying it up. The only effectual safeguard seemed to be to give licenses to such municipal authorities as were willing, with parliamentary sanction if need be, to establish and work telephone exchanges in the public interest. In 1892 the Postoffice found it to be necessary to revert to the original policy of restricting licenses to the limited area to which the license applied, and of keeping in the hands of the Postoffice all the trunk lines connecting the towns. In saying that municipal authorities ought to be granted the licenses in the public interest, it had to be borne in mind that the license asked for was a license to use what was the property of the state, which all parties seemed to think ought not to be in private hands, but ought to be worked in the public interest. He claimed the appearance of the amendment on the paper as an admission that the telephones ought to be worked in the interest of the public and not for private profit. The power to grant competitive licenses was the only weapon which the postmaster-general could use for the purpose of preventing the wholesale plunder of the public, who were compelled by business exigencies to use the telephone. In all other cases in which statutory privileges were granted to companies the dividends that could be earned or the rates that could be charged were limited or subject to control. But the telephone company might water its capital to any extent, could charge what rates it pleased, and could run up the market value of it shares to any extent in the hope that in 1911 it might compel the government to purchase the undertaking at as ruinous a cost to the taxpayer as the cost of purchasing the telegraphs. The only means of ensuring an efficient telephone service at a moderate tariff was by the use of the reserved power of granting competitive licenses. In the hands of a municipality the service would be extended to the full extent, and small tradesmen and business men would get the benefit of it at a reasonable rate. In Glasgow the National Telephone company seemed to think that it was to its interest to keep up the present high tariff of £10, and not to encourage additional subscriptions by making a reduction. The corporation of Glasgow, however, was satisfied that an efficient service could be supplied at £5 a year, and that the present number of subscribers would be doubled if the price was reduced to that figure. Why should the Postoffice refuse to a corporation like that of Glasgow a competitive license, such as the department formerly granted so frequently to private companies? The fact was that the Postoffice officials objected to giving a license to a municipal authority because their own operations in connection with the telephone had failed so conspicuously, and they did not view with satisfaction the probable success of others in the enterprise.

Griffith Boscawen said his quarrel was not so much with the National company as with the Postoffice, which allowed the monopoly to grow up. He pointed out that what people most desired was a local service. The monopoly was growing stronger every day, and the sooner it was put an end to the better. He thought it would be well if an act were passed to enable all corporations to establish telephone services without having to come to Parliament for powers. At any rate, if the government allowed competition to spring up in some form or another, the action would be most acceptable to the country.

Faithfull Begg moved an amendment to leave out all after the first word in line 1 in order to add that

"The acquisition by the state of the whole telephone system of the country is the only solution of the difficulties which exist and are increasing under the present system of licenses."

It has been said that one of the objections to the present telephone system, on public grounds, was that it was under no stautory obligation in regard to tariffs and charges such as undertakings of a similar nature were placed under by Parliament. That was owing to the fact that at the time licenses were first granted there was little expectation that so great a development of telephonic enterprise would take place within a short period. The true solution of the question was that the state should acquire the whole telephone system of the country, combine it with the Postal Department, and develop it for the benefit of the community alone. There was a prevailing belief that at the expiration of the licenses in 1911 the government would be able simply to duplicate the existing system. But the system would by that time have expanded so much that he did not think the government would be able to leave it on one side without an interruption which the public would not endure. He hoped that under no circumstances would any license be granted to any private company, because the results would be even more pernicious than granting licenses to corporations. The confusion arising from having different systems in a town was terrible. Bad as he admitted the service in London to be, the confusion would be worse confounded if they had numerous systems growing up in the metropolis. State purchase, he was convinced, presented the true remedy.

Mr. Hanbury, financial secretary to the Treasury, said the motion before the House asked that certain municipalities should be allowed to enter into competition with existing licenses of the government in the same area. At first sight that might seem a rather strong suggestion, especially when it was borne in mind with regard to the telephone business generally, that there were great difficulties with reference to competing companies in the same area. He thought, therefore, the first question which the House would ask was whether it was fair that they should allow competition to take place; and in the next place, if it was fair, whether the municipalities of the country were the best form of competition. In the early days of telephones, when little was known about them, the postmaster-general of that day had to arrive at a decision as to the course that the government should take with regard to the new system. Mr. Fawcett in those days decided that the telephone service should be carried on by the government. If that had been done it might have been the best solution of the difficulty. However, the Treasury, rightly or wrongly, ruled otherwise. It imposed on the working of the telephones by the Postoffice certain conditions which he admitted did make the competition and working by the Postoffice very difficult. The result was that Mr. Fawcett, finding that the Postoffice could not work the telephones efficiently as a government monopoly, instead of granting local licenses, which he had done up to about 1884, limiting the companies to definite areas, instituted a system of entirely free competition. He announced in August, 1884, that he would grant licenses freely to every company that applied to him, and licenses which would extend all over the country, so that any company would be at liberty to set up exchanges in any portion of the country. His idea was that, if the monopoly could not be in the hands of the government, he would take steps as seemed to him best to prevent a monopoly falling into the hands of any private company. The result showed that Mr. Fawcett made a grave miscalculation. In the first place, he omitted to recollect that in those days one company, the United Telephone company, had a great advantage because it owned patents, and it was not possible for companies generally to get patents except under the rules and regulations of the United Telephone company; but the small companies were soon bought up, so that a series of companies came under the entire control of that company. Some of these companies did become somewhat strong competitors of the mother company, and in 1889 the United Telephone company bought up the Lancashire and Cheshire company and the National company, and they were amalgamated in the National Telephone company, which now worked the telephones. In 1891 the patents expired, and it then became possible for other companies to come into competition totally independent of the mother company. Two companies were started, the Mutual company and the New company. The New company soon bought up the Mutual, and that brought the New company and the National company face to face. The Treasury minute of 1892 was drawn up with the distinct recognition of competition as against monopoly. Very soon after the issue of the Treasury minute a very vigorous flirtation took place between the two companies, and they were all but amalgamated before the agreement was formally signed. Therefore Mr. Fawcett's anticipations were entirely falsified, and the very means he took to promote free trade in competition resulted in an actual monopoly. Now that one company had swallowed up all the other companies they had a very remarkable state of things. They had not only a monopoly, but one which was not under strict control or under stringent regulations. Their railway, water, gas and electric-lighting companies were all placed by Parliament under very strict limitations with regard to their capital, dividends, rates and, especially, preferences, and on all these points this telephone company was absolutely unfettered. He thought that that was a strange state of things. Without entering into any minute calculations as to the actual value of the plant of the company, while he believed its capital stood at a value of something like £6,000,000, the Postoffice calculation was that the plant could be entirely replaced at a cost of very little over £2,000,000. Then there was a further point which had resulted from the want of competition. When he looked at the little competition there had been he could not blame the company for its defects. He was rather astonished that its service was as good as it was. He wanted to recognize that in a good many parts of the country they were giving a service about which there was no great complaint; but at the same time in several large and important towns, even in the metropolis itself, and in Glasgow and other Scotch towns, there had been complaint made of the inefficient service; and in the case of Glasgow the complaint had been proved to be true by the government commissioner, and with regard to London Mr. Forbes himself had admitted the charge to a great extent. It was most important that the country should not be behind other countries, and it was no doubt the fact that at the present moment the number of subscribers in London did not compare favorably with the number in Berlin and Paris and in some of the smaller Scandinavian towns. There was also the fact to be remembered that the service was now confined to the more populous parts of the country, that very little had been done in the country districts, and that even in the populous towns, after all, the service was rather one for the rich merchant classes than for the smaller tradesmen, who could not bear the heavy subscription in order to get the benefit of the service. He did not blame the company for this. They had only taken advantage of the grave error committed by the Postoffice in 1883. Now they had to accept the facts as they were, and to try to make the best of a bad bargain. The figures he had already given showed that they would make a very bad bargain if they purchased the company at anything like the present market value. Although both in 1890 and 1897 it was possible for the government to give notice to purchase by arbitration, two governments in succession had decided not to exercise their option. It had also been definitely decided that these licenses would not be extended beyond the year 1911. The select committee which sat in 1892 said in its report that it was perfectly willing to leave everything else to the government, but that it must make some strong recommendation that the licenses should not extend beyond 1911. That being so, the government had undoubtedly to face this difficulty. The National Telephone company was in possession of the field at the present moment. It was extending very rapidly, and, he did not hesitate to say, becoming more formidable every year. If it was known that the licenses would expire in 1911, and if the government of that day did not agree to purchase, by notice or arbitration, the plant of the company, its assets generally, it might be, its good-will, and even the wayleaves the government had conceded to it, it was possible that the company, seeing that there were only a few years to run, might take the opportunity of trying to put the Postoffice and the Treasury in a difficulty —he did not say unfairly. Possibly the company would not agree to a bargain, and unless the government had started themselves very early, with an entirely new plant of their own, the company would be unwilling to sell to them, and raise their rates, with the result that there would be such an outcry in the country that the government might have to buy out the company at its own price. This evil, however, might be avoided to a limited extent by competition. What was the best form of competition? He did not believe that competition by companies would be by any means the proper course. Then competition by the Postoffice had not been a success, so far. He thought that the reason why the Postoffice had not competed, even in its own exchanges, was partly the idea that it ought to

work harmoniously with the company. With regard to the greater portion of the area of the country, he admitted it was necessary to work in amicable relations with the company. They must remember that those Treasury regulations, which were framed in 1882, and which caused Mr. Fawcett to throw the whole of this valuable service to open competition, were still in existence, but they now proposed to abolish them; they proposed to enable the Postoffice to try and canvass for work in just the same way as any private company. He was afraid that even when they had done that there was a difficulty which militated against the success of the Postoffice exchanges even more than the Treasury regulations. He had said already that the National Telephone company had got certain unrestricted privileges which, so far as he knew, were enjoyed by no other monopoly. It had got the privilege of granting preferences to particular subscribers, and by means of giving free wires or reduced rates to large men who would bring them a large amount of business, they did what the Postoffice exchanges naturally could not do, because they could not give preferences. A promise had been given over and over again by various postmasters-general in that House, and he had repeated that promise only last session, that if in any case where there was a dear or unreasonable service, and no competition it would be the duty of the Postoffice itself, if necessary, to enter the field and extend the exchange. There was the less objection to their doing so, because although the Postoffice might be blamed for not having worked its exchanges as vigorously as it might have done, still in spite of all the difficulties—and the question of preferences was a serious one—the Postoffice exchanges had paid the Postoffice a very large interest on the money expended. Therefore from a financial point of view there was very little reason why the Postoffice should not where necessary extend its exchanges, and if it did so of course it would be gradually preparing for the day when the whole of the telephone system would fall into its hands. Then they came to another class of competition which had hitherto not been dealt with. Until at any rate 1892 the municipalities were about the only bodies who could not well enter into telephonic competition with the company, because of the general licenses granted all over the country, including the right to work the trunk lines. The municipalities were the only bodies whose action must necessarily be confined to their own areas, and they were therefore shut out from competition. The municipalities or local authorities were perfectly willing, as he understood, to undertake licenses and to work them on condition that in 1911 they absolutely surrendered those licenses to the government. That was one argument undoubtedly in favor of the local authorities. Another argument was that they certainly would not be bought up as a company might be, and in addition they had wayleaves and would be able therefore to lay an efficient underground service. Municipalities argued also that, while they were willing to allow their streets to be taken up for their own exchanges, they did not wish those streets to be at the mercy of any private company. He thought there was a great deal of justice in that contention. Under the Treasury minute of 1892 the municipalities had an absolute control over any new companies, and no new company could work within the area of any local authority unless it got the permission of that local authority. Therefore if they were not going to allow the municipalities to compete he did not quite see what chance of competition there was from other sources. On the other hand, there were serious difficulties involving questions of policy which Parliament itself ought to decide. Even if they were to grant a license to the Glasgow corporation, for instance, although Glasgow had got a common fund, differing in that respect from the English corporations, it would not be able to exercise that license, and there would be no use therefore in doing so. There were two questions of policy to be considered in granting licenses to municipalities. Hitherto undoubtedly the telephone in England was more or less a luxury of the rich, although it was not confined to the richer classes in other countries. That was at any rate one question which the select committee which they proposed to appoint would have to decide—whether a telephone service was a matter of such general benefit to the community living within the area of a municipality or local authority as to justify the local authority in using public funds for the purpose of undertaking telephone work within the area. That was a question which a department ought not to decide, and which ought to be left to Parliament. There was this further peculiarity with regard to the telephone service, that there must be, even with regard to large municipalities, areas outside, which it would not be for the public convenience to include in the area of the municipal exchange. He was bound to say that by some means or other certain areas had already been assigned to the National Telephone company which even the largest municipality could not possibly embrace within its operations. The area of the exchange of London he was told, had 750 square miles—an area a good deal larger than even the London County Council would possibly attempt to work. He should have thought with regard to a large body like that, that if a license were granted to it it ought to be contented with its own area. What they proposed was to appoint a select committee of the House which should confine itself to two legal points, namely, whether any change in the law should take place which would, by the removal of restrictions, make it possible for a municipality to engage in such an undertaking, and how far this extension of the telephone system in the hands of persons other than the Postoffice was likely to damage their revenue. There was a feeling now at the Postoffice, for which he thought there was some justification, that if a telephone service was properly worked in close communication with the Postoffice, so far from damaging the telegraph service it might actually assist it.

The motion was then negatived without a division.

Disclaimer in Firman Patent.

Among the announcements made in the Official Gazette of the United States Patent Office of April 12th, the following item of interest to telephone men appeared under the head of "Disclaimers:"

252,576.—LEROY B. FIRMAN, Chicago, Ill. IMPROVEMENT IN MULTIPLE SWITCHBOARDS FOR TELEPHONE EXCHANGES. Patent dated January 17, 1882. Disclaimer filed April 8, 1898, by the present assignee, the Western Electric Company, Chicago, Ill.

Enters its disclaimer:

"To the said second claim in the specification of the said letters patent, which is in the words following, to wit:

"2. The combination of two or more multiple boards to which the lines of the terminal stations are connected, and means, as described, whereby the switchman may readily ascertain what lines are in use."

Enclosed Arc Lamp.

A modification of the enclosed arc lamp has recently been perfected by the General Electric company, which, while preserving the essential features of the well-known direct and alternating-current

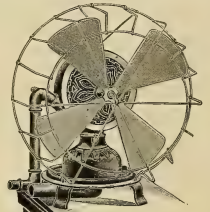
ENCLOSED ART LAMP

lamps, with enclosed arcs, substitutes a flared porcelain reflector for the outer globe. The mechanism of the lamp is similar to that of the standard enclosed arc lamps, but the use of the reflector instead of the globe allows a large amount of light, which otherwise would be absorbed in the outer globe, to be thrown down by the reflector and thus utilized. Calculating this absorption of light at from 10 to 30 per cent., the single-globe lamp allows of the utilization of just so much of the total light from the arc, as well as that which is reflected. In cases in which the direct light from the arc is not objectionable and a general diffusion of the light not absolutely desirable, such as in cafes, hotels, restaurants, etc., the single globe is peculiarly adapted.

In designing the lower part of the frame, care has been taken to render it both light and delicate and yet sufficiently rigid to withstand ordinary usage, without interfering to any extent with the passage of the light or casting heavy shadows. It is highly nickeled and thus, during the daytime when the light is not needed, the ornamental appearance of the lamp is not detracted from. The inside of the porcelain shade is highly polished and gives a good reflecting surface. It is interchangeable and can be used with globes for either direct or alternating enclosed arc lamps. By an arrangement of the lower rim of the cover of the mechanism the reflector may be substituted for the outer globe of the double-enclosed arc lamps. As in the direct-current double-globe lamps, a simple adjusting coil allows of the use of 5, 4½ or 4 amperes. By using a reflector instead of the globe a very satisfactory light may be obtained from this lamp with a current of only four amperes. A reactive coil in the alternating lamps allows of adjustment for any line voltage between 100 and 120 volts and frequencies of 60 and 125 cycles.

Triumph Water-driven Fan.

The cut represents the Triump water-driven fan, manufactured by the Specialty Manufacturing company of Indianapolis, Ind., which is especially designed for use on counters, dining tables, bedrooms and various other places where a fan is needed. This fan is run by water pressure, and it is said that a one-sixteenth-inch jet of water operates the motor at full speed. It is used with hose connections to service pipe and hose for waste, it



TRIUMPH WATER-DRIVEN FAN.

may be placed in an out-of-the-way place, and the course of the breeze may be directed at will. These fans are so simple in construction that anyone who can screw a hose coupling on an ordinary pipe or faucet can attach them without any additional expense.

The brass nickel-plated motor is attached to a base which is ornamental and beautifully enameled. The fan complete weighs 15 pounds and measures about 15 inches from bottom of the base to the highest point. It has 12-inch blades and runs at high speed and moves an abundance of air. The Specialty Manufacturing company also manufactures water motors of various sizes for running telephone generators, sewing machines, fans, coffee mills and other small machinery.

Electric Bicycle Lamp.

The accompanying cut shows a new bicycle lamp placed on the market by the Portable Electric Light company, 1242 Marquette building.

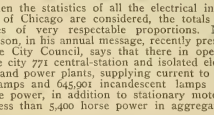
The lamp light or reflector is made entirely of brass, nickel-plated, and contains an incandescent lamp, together with an imported ground lens. The bicycle reflector can be attached to head or fork of frame as desired.

The batteries are perfectly dry and are put up in cartridge form, and when exhausted are to be replaced by new cartridges, which can be purchased in all prominent locations, ready for use at a moderate cost, thus avoiding all inconvenience of charging or cleaning, as is necessary with storage and primary batteries.

The bicycle battery is neatly enclosed in a tubular leather case and will fit any make of drop or diamond frame on the markets. These batteries with the Marquette special incandescent lamp will burn, it is claimed, fully 15 hours, the last burning hour being of equal brilliancy to the first.

Chicago's Electrical Plants.

When the statistics of all the electrical installations of Chicago are considered, the totals reach figures of very respectable proportions. Mayor Harrison, in his annual message, recently presented to the City Council, says that there in operation in the city 771 central-station and isolated electric-light and power plants, supplying current to 27,193 arc lamps and 645,901 incandescent lamps of 16 candle power, in addition to stationary motors of not less than 5,400 horse power in aggregate ca-



ELECTRIC BICYCLE LAMP.

pacity. This is exclusive of the surface and elevated railway plants, which have a combined generator capacity of at least 40,000 horse power. Undoubtedly the electrical plant actually in service in the city at the present time has a capacity of considerably over 100,000 horse power.

The mayor devotes considerable attention, in his report, to the municipal electric-light system of the city, in which he is greatly interested. He says that during the year 1897 the number of 2,000 candle power arc lamps added was 183, the greatest annual increase since 1890. The average installation cost, including underground work, was $200 a lamp. The city now operates 1,438 arc lights from its own

plants, and during this year the system will be greatly extended, an appropriation of $150,000 having been made for the purpose. The city also rents 531 lights, making the total number of street arc lamps in Chicago 1,969. These lights are placed as follows: North Side, 241; South Side, 1,116; West Side, 612.

On the important question of the cost of maintaining the municipally operated lights the mayor does not give details nor indicate the manner in which the figure given for maintenance—$90.65—is arrived at. The paragraphs of his report relating to this subject are as follows:

"The maintenance of the electric-lighting system during 1897 was on a basis of $90.65 per lamp per year. The first six months the lamps cost on an average of $46.73 each; for the second six months an average of $43.92 each. The cost per hour per lamp for the first six months was .0245; for the last six months, per lamp per hour, .0216.

"The electric-light department has been entirely reorganized; more efficient machinery installed in the stations, which for the last six months show a saving that warrants a guarantee that the electric lighting this year will not cost to exceed $83 per light per year.

"The repairs for electric-lighting maintenance by the city were discontinued on August 5th, and repairs are now made by contract. This shows a net saving in cost of $570.71 per month. All the improvements made in the electric-lighting system have been charged to the maintenance of the system, and to secure economical operation of the system it has not been necessary to expend any large sums of money.

"During the last six months of 1897 the cost of coal was nearly double what it was the preceding six months, on account of a strike of the coal miners. This additional price for coal materially increased the cost of last year's lighting, making a difference of nearly $4 per light per year. The conditions under which the new lights will be installed, and the guarantee obtained on the apparatus used in producing lights, warrant the statement that the new lights, as installed, will not exceed a cost of $75 per light per year.

"The inventoried value of the electric-light system January 1, 1898, was $797,431.11."

The city has three arc-lighting stations for street lighting and 220 miles of underground circuits.

Considering the work of the city bureau of electrical inspection, the mayor says that the reports show that there is a very rapid increase in the use of electricity for light and power. It has been found necessary to enlarge the department to properly inspect the electrical work of the city as it is being installed. The total receipt from the fees for electrical inspection in 1897 were $16,248.52 and the expenditure for the bureau of inspection was $10,-010.18, leaving a balance of $5,338.34. The number of fires during the year ascribed to electrical causes is 91 and the total loss from these fires $9,515. But one of these fires was a serious one. The loss amounting from this fire was $8,000; the remainig $1,515 of the total loss was due to 90 fires.

On the subject of the electrolysis of buried metal pipes, resulting from the use of grounded street-railway circuits, the mayor remarks that the damage is increasing, as shown by tests, and reports that the matter has been referred to the Law Department, with instructions to protect the city's interests.

Armature Construction.

In the construction of the armatures of all direct-current generators and motors built by the General Electric company especial care is had to the production of as perfect and durable a part as possible, without sacrificing any detail essential to efficiency and perfect operation. New ideas have been incorporated, and old and tried features retained. The wire, iron and copper, must reach a certain standard of excellence or be rejected; each step in construction is carefully inspected and the completed armature is subjected to a test many times more severe than the severest conditions which would be met with in actual service. Nothing is left to chance.

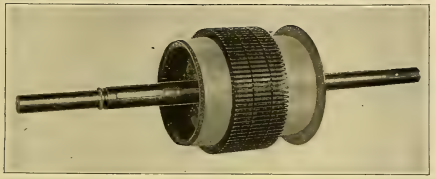


Fig. 1.

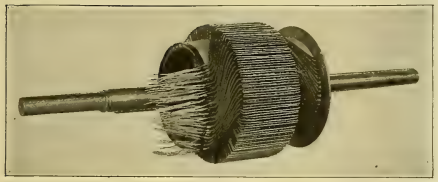


Fig. 2.

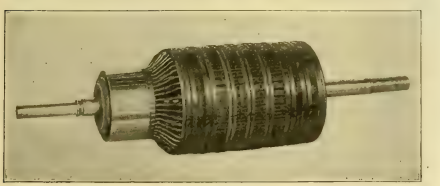


Fig. 3.

ARMATURE CONSTRUCTION

In the armatures of the new type of slow and moderate-speed direct-current generators and motors these characteristic features are strikingly apparent. The completed armature is a slotted body of barrel shape, so built that no part is susceptible to movement or vibration. There are no sharp bends to the wire over sharp metallic edges, and each coil is so laid on the core that the outer periphery of the core itself affords it complete protection from mechanical injury.

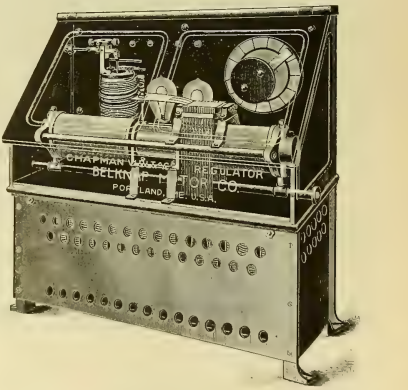
The spider castings holding the slotted sheet-iron laminations are extended into cylindrical flanges at both ends. The coils, previously shaped on a form, are laid in the slots, and the ends lie along those flanges at each end of the spider instead of being bent down sharply toward the shaft. The coils are formed and insulated before assembling on the core, in order that, before application in their final position, they may undergo a careful test, and no coil is used that does not emerge from this with insulation intact. The insulation used is similar to that employed in the General Electric railway motors, and in the operation of these it has given ample proof of its excellent qualities. It is tough, impervious to moisture and practically indestructible except under abnormal overload, while it affords high resistance to puncture, rendering injury from lightning extremely improbable. The insulated coils are laid in place in insulated slots in the core and are simply pressed home. The advantage of this method, compared with that employed on an armature with the wire wound directly upon it, is obvious.

The cylindrical winding has many positive advantages. A very large radiating surface is provided for the conductors, and this, combined with special air ducts for the passage of currents of air through the core from the interior outwards, tends to keep the armature cool; the length of wire is reduced to a minimum, and consequently the losses due to armature resistance are also reduced, while the efficiency of the machine is greatly increased. The complete coil being formed separately and then applied, any one or more coils may readily be removed and replaced.

The coils are firmly secured in the slots on the cylindrical extensions so that no part can move or vibrate. Indeed, rigidity is one of the most important advantages of the cylindrical winding, since without motion of the parts neither injury nor deterioration of the insulation is likely to occur. The ends of the coils are curved down to the commutator, and the connections are so arranged that open-circuiting is impossible. The illustrations show the three different steps in the construction of a General Electric slow and moderate-speed generator armature from the completed core (Fig. 1) to the completed armature (Fig. 3). Fig. 2 shows the method of applying the coil to the core.

New Voltage Regulator.

The new Chapman voltage regulator, manufactured by the Belknap Motor company, Portland, Me., embodies all the essential principles of the original type, but is constructed in a more simple and effective form, the working parts being reduced to a minimum and arranged for the greatest convenience of manipulation, the needs of central stations having been more carefully studied. It consists of three essential parts—a set of resistance coils to be inserted or removed from the field-magnet circuit of the generator to be regulated, a working solenoid to do the work of inserting and removing the coils from the circuit, and an auxiliary or relay solenoid to determine the movement of the working solenoid. The resistance coils are made of German silver, of a size sufficient to give ample radiating capacity for the field current of the generator for which they are constructed. They are connected to a series of copper segments placed in a horizontal row, and having a contact slider arranged to move over their surface. This contact slider is mechanically connected to the moving core of the working solenoid. The working solenoid consists of two differentially wound coils of wire placed on a brass tube, one at each end of the tube, and the whole placed in a horizontal position. The middle portion of the tube is left vacant. In side of the tube a soft iron plunger is fitted as a piston to the tube and somewhat shorter than the distance through the two coils; at the center portion of plunger a rod is attached which passes out through a longitudinal slot cut in the vacant portion of the tube. The contact slider above described is attached to this rod and so moves with it and with the iron plunger. In order to prevent too quick a movement of the plunger a simple and ingenious retarding device is used, in which the moving iron plunger is made to serve as a dash-pot. From one end of the brass tube to the other a small pipe is connected, having a hand valve in it, to regulate the flow of oil. The two



NEW VOLTAGE REGULATOR.

ends of the brass tube, together with its connecting pipe, are completely filled with oil and closed up tight. The movement of the iron plunger toward either end can then take place only as it displaces this oil and causes it to move through the pipe and to the other end, and the rapidity of this movement can be very finely adjusted by means of the valve above described.

The force tending to move the iron plunger is the difference between the attractions of the two end coils, and this balance is maintained or upset by the action of the small auxiliary solenoid, whose only work is to cause one or another of the two platinum-pointed screws to make contact with the brass lever supporting its core. Contact with one screw causes perfect neutralization of the differential coil at one end of the working solenoid and so disturbs the balance and causes the plunger to move toward the other coil, and contact with the other screw causes neutralization of the coil at the other end and a movement in the other direction. The small solenoid may be wound to suit a variety of purposes, any one of which may be required in station regulation. It may be wound with a simple fine winding to be connected as a shunt across the lines to be regulated, and in this case it will secure constant potential regulation at the point of attachment to the line. Or it may be wound with a fine winding connected as a shunt to the line and a coarse winding in series with the line, in which case it will regulate for constant potential at some distant point which may be predetermined by the setting of an adjustable compounding switch provided as a part of the regulator. Or the small solenoid may be wound with a single coarse wire placed in series with the line; in this latter case it will secure regulation for constant current in the lines. But whatever be the nature of the regulation the small solenoid will perform its duties with an accuracy as close as one per cent above or below the normal, and is adapted to either direct or alternating currents.

Alternating currents are especially capable of close regulation by this instrument, as the slight jar incident to their flow through the small solenoid almost entirely eliminates the element of friction at the pivots of the lever supporting the core, and it will easily recognize a change of one half of a volt on a 110 volt circuit. The economy of good regulation is at once apparent when it is remembered that the life of an ordinary incandescent lamp of 50 watts and 16 candle power is greatly shortened if operated at a voltage jumping at times to a few per cent. above the normal.

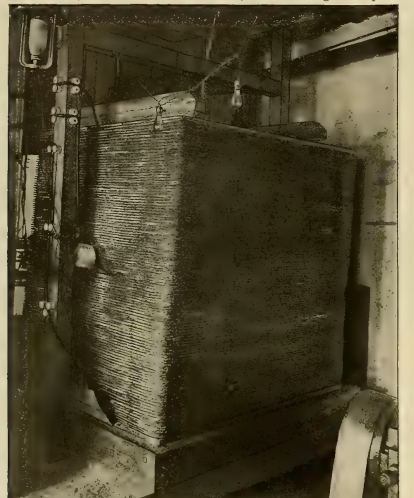
This regulator may be so applied to the regulation of a constant current as well as a constant voltage, and when used for this purpose will be found especially useful in the charging of storage batteries, as it maintains a constant current from the time the charging commences until it is completed. To accomplish this result it is only necessary to add a separate solenoid, wound with a coarse wire, a double-point switch being used to shift the apparatus from the constant voltage basis to the constant-current basis of regulation.

Remarkable High-tension Storage Battery.

Storage batteries have been constructed in a great variety of shapes embodying numerous ideas intending to increase their efficiency or their life. But what may fairly be claimed to be the most remarkable storage battery of all is that now employed in furnishing current for lighting the village of Souderton, Pa., a town of some 3,000 inhabitants, situated about 30 miles from Philadelphia.

This battery is shown in the picture. It consists of 110 lead plates, piled one above the other, each plate six feet wide by seven feet long; the total height of the battery is seven feet, and it weighs no less than 16 tons. What is particularly striking is that the plates are exposed without any enclosing tank whatever.

Before going into the details of the construction of the cell it may be well to recall that it is now several years ago that Prof. N. H. Edgerton, whose electric motor will be recalled by many engineers whose memories go back to the beginning of electric-motor work, conceived the idea that a battery could be made which would furnish any desired potential and in a form practical for every class of work. Working along this line, Prof. Edgerton's work finally crystallized into a type of battery in which each plate formed, as it were, a couple by itself, one side acting as the positive and the other as the negative in a battery, and thus, at the very outset, reducing the number of plates required one-half. The next problem was to group these plates so that they could be maintained in position to permit of the introduction of the necessary electrolyte, and to keep it in place.



REMARKABLE HIGH-TENSION STORAGE BATTERY.

In the battery illustrated each plate of the cell, excepting the one at the bottom, is coated on its under side to the depth of one-eighth of an inch with litharge. This forms the negative side of the plate. In the hollow on the top of the plate is a layer of red lead, also one-eighth of an inch in thickness, which is covered with a thin sheet of asbestos, and on this again is spread a layer of granulated oak charcoal, covered with a sheet of muslin. The plates thus prepared are piled one on top of the other, the result being that, as above stated, each plate constitutes in itself a positive and a negative, with the result that there is an electromotive force of 2.2 volts between each two contiguous plates. The electrolyte, of sulphuric acid, is syphoned in between the plates and is absorbed and held in place by the granulated charcoal.

In the Souderton battery 110 plates of this kind are piled one on top of the other, so that at the terminals there is a pressure of 220 volts. Actual measurements with a Weston voltmeter showed a difference of potential of 225 volts on open circuit, and the normal capacity of this battery is 3,000 ampere-hours.

This large cell is located in the works of the High Tension Electric Storage company, and, as stated above, furnishes current for all the public and private lighting in that town, consisting of 24 arcs and 600 incandescent lamps, the latter connected to three-wire circuits.

For the charging there are employed three dynamos, two of 40 kilowatts capacity, respectively of the Eddy and C. & C. type. One of these machines is of 250 volts and the other 500. A third machine, built by the Electro-dynamic company, is of 110 volts, and is employed as an equalizer to feed either side of the 220-volt battery which may be required to be brought up in charge equal to the other side when the two sides are unequally drawn upon. This great cell is charged at 250 amperes, but this can be raised to 2,000 for a short time without injury.

The advantage claimed for this type of a cell is that it is impossible for any of the active material to fall away from the plate, so that it constantly maintains its original capacity, while at the same time preventing short-circuiting between the plates. It is also pointed out that the current passes through from one plate of the cell to the other with absolute uniformity of density, each square inch giving out and receiving as much current as at every point on the plate, so that the action on the active material is absolutely uniform throughout. Then, again, the question of terminals is practically done away with, as there are only two terminals in the whole battery of 220 volts, one at each end plate.

While the battery just described represents the largest work of the company thus far undertaken, it is evident that there is hardly any limit to the potential which can be obtained by cells constructed in this manner. It is stated that the company is now about to undertake, on an order, the construction of a battery to deliver 1,000 volts.

It will be evident, however, that besides central-station work the battery is adapted for private plants and for portable work. Thus, among the electric-lighting plants equipped with the high-tension storage battery, is that in the Independent building at Souderton, Pa., where 20 16 candle power lamps are installed, operated from the storage battery. This battery is charged with a dynamo run by a two horse power Witte gasoline engine, which also furnishes power to run a large cylinder press and paper folder.

The company has designed a large variety of types of batteries for special work, such as for the use of physicians, batteries for lantern projection and for general uses of all kinds. High-tension battery of the type described has been in actual operation lighting an apartment house in Philadelphia during the last two years.

The works of the company are situated at Souderton, Pa., and are thoroughly equipped for carrying on the company's work. They are located directly opposite the tracks of the Reading railroad, so that the shipping facilities are of the best. The offices of the High-tension Electric Storage company are in Philadelphia. Prof. N. H. Edgerton, inventor of the battery, is president of the company, and the following-named gentlemen are the officers: Dr. Joseph H. Wilson, vice-president; A. M. Gissinger, secretary; J. K. Clenner, treasurer; J. B. Alderfer, general manager.

National Electric Light Convention, Chicago, June 7th, 8th and 9th.

The most popular line from Cincinnati, Louisville and all points South to Chicago is the Big Four Route via Indianapolis; magnificent sleeping cars and unequaled dining-car service. For maps, rates, etc., address E. O. McCormick, passenger traffic manager, Big Four Route, Cincinnati, O.

CORRESPONDENCE.

New York Notes.

New York, April 18.—Much regret is expressed in electrical circles at the failure of Alfred Dolge & Son of Dolgeville, N. Y., last week. Surprise was created by the application for a receiver for the firm, as Mr. Dolge's large enterprises were thought to be in good shape. The nominal value of the assets is placed at $1,150,000, but the liabilities are about $1,400,000. Mr. Dolge was engaged in the manufacture of felt products and in several other enterprises. His principal object in life was the building up of the village bearing his name, which was considered a thriving manufacturing town. About 2,500 persons are dependent on the Dolge enterprises for a livelihood. Alfred Dolge was one of the pioneers in the utilization of electric power for manufacturing industries, and the second Edison dynamo was purchased by him. The water power was transferred into electric energy to run his mills, and then he began plans for the construction of power development on a larger scale. He purchased 40,000 acres of virgin Adirondack forests, in which are located several lakes. Then the Dolgeville Electric Light and Power company was formed, and the line was extended to Little Falls. The plant is capable of producing 4,000 horse power, and exports say that it can be increased to 12,000 horse power. This electric power Mr. Dolge designed to furnish the towns throughout the Mohawk Valley.

A majority of the stockholders of the Kings County Traction company have voted in favor of dissolving the company. The directors, it is said, will proceed to wind up the affairs of the company, dispose of the assets, and, after paying the debts of the company, divide the balance among the

stockholders. It is likely, however, that this step will not be taken without a strong fight by the dissenting stockholders, who, it is understood, have asked the attorney-general of the state for an investigation.

It is probable that the familiar steam-railroad cars on the Brooklyn bridge will be withdrawn from service as soon as the elevated railroad companies begin operating over the bridge, thus effecting a saving of $50,000 a month in the running expenses. Superintendent Martin says that with the "L" trains and trolley cars both in operation the bridge railroad could be abandoned. He believes that the revenue derived from the railroad companies for their exclusive privileges would be ample to maintain the bridge. Commissioner Shea will soon have a conference with the railroad officials in relation to fixing the tolls. At present the trolley companies pay five cents per car per round trip, and Mr. Shea regards this amount as entirely too small. He expects the companies to be willing to come to an agreement with the city without any litigation.

John H. Starin, one of the Rapid Transit commissioners, left the city for Europe on Saturday. Members of the commission say that Mr. Starin's trip at this time involves no inconvenience, especially as it is probable that he will stay abroad only a short time. The commission will have practically no business of importance to transact for a month at least. It will take no action toward awarding the contract for the underground road until the time allowed to the Manhattan Elevated Railroad company to consider the advisability of accepting or rejecting the franchises offered it to it has elapsed. Again, the commission cannot proceed with the contract until a reasonable time has been allowed to Corporation Counsel Whalen to pass upon it, and it is assumed that Mr. Whalen, following the policy of the administration, will withhold his judgment as long as possible.

Mr. Samuel Insull, president of the National Electric Light association and of the Association of Edison Illuminating Companies was in New York last week. He takes a lively interest in the progress of the electrical exhibition and has informed the management that he will take the utmost pleasure in coming on especially from Chicago, in behalf of those two associations or bodies, to participate in the opening exercises on May 2d. These exercises as now arranged promise to be of an unusually striking and interesting character. The preparations for the event are proceeding with unabated vigor. Arrangements have been made for the meetings of about 50 associations of stationary engineers. These associations will come from New York, New Jersey, Pennsylvania, Massachusetts, Rhode Island and Connecticut. Several rooms suitable for meetings have been provided, and the various lodges invited, almost without exception, have accepted the invitation and will hold their meetings there on their regular meeting night as the guests of the Exhibition company. W. F. O.

PERSONAL.

T. W. Ness, representing the Holtzer-Cabot Electric company of Boston, visited Chicago electrical men this week.

J. S. Daily, manager of the Chillicothe (Ill.) Water, Electric Light and Power company, was a Chicago visitor last week.

William Goltz, the well-known electrical man of Milwaukee, has connected himself with the firm of Meysenburg & Badt of Chicago in the capacity of secretary.

W. R. Mason, the representative of the Walker company in St. Louis, was in Chicago on Monday visiting friends. He reports a fair outlook for business in St. Louis.

Edward R. Knowles, the well-known electrical engineer of New York, has accepted the position of superintendent of the power motor department of the Sprague Electric company.

J. F. Stevens of Philadelphia was among the out-of-town electrical men who have been visiting Chicago recently. Mr. Stevens represents the Keystone Electrical Instrument company.

Mr. N. G. Harvey has resigned his position with the Gould & Eberhardt company to accept the management of the house-goods department of the Illinois Electric company of Chicago. Mr. Harvey has been in the business a number of years and has many friends in the electrical fraternity.

ELECTRIC LIGHTING.

The contract for four water-tube boilers of a nominal capacity of 500 horse-power each for the new street are lighting-plants of the city of Chicago has been awarded to the Aultman & Taylor Machine company of Mansfield, Ohio, for $67,800. One boiler will be placed in the Fourteenth street station, another at the new plant at Rice and Lincoln streets, and the others in new plants that have not been definitely located.

ELECTRIC RAILWAYS.

Recently the last horse car was taken off the streets of Budapest. The surface lines have been converted into an electric system, while the Budapest underground railway also has electric traction for a distance of 53 miles. Plans for an extensive system of electric elevated and underground railways have just been made public and received with general approval. At the present time Budapest is the only large town in Europe in which the horse car has been banished entirely from the streets.

The Main street inclined plane and Mount Auburn electric line in Cincinnati, Ohio, over which there has been much litigation, were sold at auction on April 14th by order of the United States court. The property as a whole was bought in by the Cincinnati Consolidated Street Railway company for $278,000. Many street-railway men attended the sale.

Work on the Cicero and Harlem extension of the Lake Street elevated railroad of Chicago, from the terminus of the line at Fifty-second avenue westward, has been begun. The time allowed for the completion of the work expires on September 15th, but as the iron for the superstructure cannot be delivered so soon the town board will be asked for and will probably grant an extension of 60 days.

Superintendent Nagle of the Chicago City Railway company applied to the mayor last week for permission to string trolley wires in State street between Van Buren and Randolph streets, to complete the system of temporary down-town trolley loop. The mayor refused the application. He says that under no circumstances will he allow the stringing of trolley wires in State street north of Van Buren street.

ELECTRICAL SECURITIES.

A concern entitled the Standard Electric Magnetic Power company has been chartered with a capital of $5,000,000 to operate a plant at Martinsburg, W. Va.

The Columbus Street Railroad company reports gross earnings for March of $51,729, an increase of $4,062 as compared with the same month of last year, and net $27,231, an increase of $5,328.

Directors of the Edison Electric Illuminating company of Boston have declared the regular quarterly dividend of 1¾ per cent., payable May 2d. Books will close April 15th and reopen May 3d.

The Sprague Electric company of New York has declared a dividend of three per cent. upon the preferred stock, payable May 2d to stockholders of record April 18th. The organization was incorporated last October with an authorized capital of $5,000,000, of which $2,500,000 is six per cent. preferred.

The North Chicago Street Railway company will increase the capital stock by 20 per cent., from $6,600,000 to $7,920,000, to take up debentures and wipe out debts incurred for extensions and betterments and the substitution of electricity for animal power. The authorized capital stock of the company is $10,000,000.

On the acquisition of the People's electric street railway of Amesburg, Mass., by the Lowell, Lawrence and Haverhill Electric Street Railway company, the managers of the latter company approved the issue of five per cent. first-mortgage bonds amounting to $65,000, the proceeds to be used in retiring the outstanding capital stock of the People's company, on a basis of one bond for 10 shares of stock.

Efforts are being made to reorganize the Pennsylvania Traction system, which has been in the hands of a receiver for nearly two years. William B. Given is said to have secured $550,000 of the $600,000 bonds issued on the Lancaster city lines, and has also purchased two-thirds of the bonds secured on the Columbia and Ironville and Donegal roads. Negotiations are pending for the Lancaster and Columbia line. It is said that the Provident Life and Trust company of Philadelphia is behind the deal, and that several financiers and business men of Lancaster will coöperate in the new organization.

MISCELLANEOUS.

The Treasury Department is inviting sealed proposals until April 26th for installing an electric light and power plant in the United States courthouse and postoffice building at Louisville, Ky. Specifications and plans can be obtained upon application to O. L. Spaulding, assistant secretary of the treasury, Washington, D. C.

TRADE NEWS.

The Electric Exhibition company of New York has practically completed all arrangements for the opening of the exhibition on May 2nd. It has moved its headquarters from 15 Cortlandt street to Madison Square Garden, where the executive office of this company will be hereafter located.

The Sprague Electric company has issued two attractive catalogues relating to its Lundell motors. One, on "Electric Motors in the Art of Printing," is especially artistic and well printed. The other describes the '98 models of the Lundell fan motors and is also a handsome catalogue. Both will be valuable aids to purchasers.

The D. A. Kusel Telephone and Electric Manufacturing company of St. Louis has found it necessary to move to larger quarters, owing to the constantly increasing demand for its well-known products. The company is now located at 1105 Pine street, and is in a better position to-day to fill orders than at any time heretofore. The company states that it has just closed a contract for an exchange at Muscogee, Indian Territory, for a 125-drop switchboard and 75 telephones.

The new catalogues of the Diamond Rubber company of Akron, Ohio, show a fine line of mechanical rubber goods, such as belting, hose, packing, wheel tires, etc., and also of small metal fittings, as couplings, nipples, reels, nozzles and the like. It is announced that the organization of the company is now centered in the president, Walter B. Hardy, who is stated to possess an intimate knowledge of the needs of the trade and also the skill and experience necessary to supply them.

The Central Electric company of Chicago is now furnishing the celebrated Manson tape put up in neat tin boxes, holding one-half pound each. This innovation will be readily appreciated by the many users of his product, as it preserves the tape in a fresh condition and also prevents filings and the many particles of metal always found in a "kit" or on a bench from adhering to the tape and destroying its effectiveness. The company is carrying in stock a full and complete line of the celebrated McIntyre connectors, as well as the various tools used in connection therewith.

The Jersey Electric company of 744 Broad street, Newark, N. J., a concern recently organized to extensively operate in the renewing of incandescent lights. It has been particularly careful to get experienced help in this line of bousiness, so that the production may be superior to any renewed lamp manufactured. Mr. Harry Gregory, who has been elected treasurer and general manger, is a gentleman well known in the electrical business, and is ably assisted by Mr. Thomas G. Westcott as general sales agent. It is the new company's idea to locate agencies in different portions of the country. It now has a standing cash offer for incandescent lamps that have been cast aside.

The electrical trade will be interested to know that the American Electric Fuse company is now installed in a new and spacious factory in Chicago at 521 to 531 Wabash avenue. For over a year the company has felt the need of more commodious quarters, owing to the phenomenal increase in its business. It has been holding itself almost exclusively to the production of electric fuses and wire connectors in addition to selling other supplies, but, owing to the popularity of the company's goods, especially among the telephone and telegraph people, the old quarters were found entirely inadequate to take care of the greatly increased business. The present quarters on Wabash avenue place the company in a position to take care of the greatly increased amount of business. A special fuse-wire machine designed Mr. Masstadt of the company has just been installed. This machine turns out an immense amount of fuse wire in a day and places the company in a position to fill all demands.

BUSINESS.

The Western Electric company announces that it has the exclusive agency for the Sprague Electric company's conduit and has in stock in Chicago a large and complete supply of interior conduit of all sizes, upon which it is prepared to quote the lowest prices.

The Ball Engine company, Erie, Pa., which builds engines exclusively for electrical purposes, is reported to be crowded with work. The good reputation of the Ball engine built by this company has, of course, much to do with the satisfactory condition of its order book.

The Farr Telephone and Construction Supply company, 357 Dearborn street, Chicago, is meeting with flattering success, and is doing a large business to-day than ever before. The company desires to place in the hands of every telephone user a copy of its catalogue, which contains valuable information for telephone users.

Queen & Co. of Philadelphia present in a new circular a description of their Queen-Acme portable testing set. Their claims on this instrument as to range and accuracy of measurement are very wide. The testimonials in the new circular suggest that the set is widely used, both in this country and abroad. This descriptive pamphlet will be sent on application to those interested.

The Berlin Iron Bridge company of East Berlin, Conn., has just completed at Grand avenue, New Haven, Conn., a steel bridge 427 feet in length, 52 feet in width, with one roadway and two sidewalks. The approaches on the bridge consist of two deck plate-girders. The draw span is 200 feet in length and is operated by electricity, which is employed for lighting the bridge by night. The bridge is to very heavy construction, the roadway being paved with vitrified brick adapted to heavy city traffic.

The Central Electric company of Chicago is active and energetic as ever in the pursuit of business. It has issued a little circular on "Tape Talk," relating to the familiar Okonite product. It claims that its stock of house goods is the most complete stock of the kind and says that increased orders in this department give evidence of the popularity of large stock and favorable prices. Attention is also called to the fact that the Central can

ries in stock all sorts of electrical heating and cooking utensils.

Probably one of the most useful and interesting books on insulation ever issued is now being mailed to the electric street railways and electrical manufacturers throughout the country by the Mica Insulator company of New York and Chicago. The book is made up so that each page of reading matter, aside from the title and index pages, is descriptive of the "sample of insulation" preceding it. The company will be pleased to mail upon application to those who are users of high-grade insulators a copy of this manual, and also calls attention to the fact that its materials are carried in stock both at New York and Chicago.

Broomell, Schmidt & Co. of York, Pa., manufacturers of the American fuel economizer, report that they have more business in sight at present than at any time during the past year. Their shops are running to their full capacity to keep abreast of orders. They are now at work on an installation of their apparatus for the Gardner Electric Light company of Gardner, Mass., and they are also completing the installation of seven economizers for the Arbuckle Sugar Refining company of Brooklyn. This apparatus will take care of the gases from boilers to the capacity of 4,800 horse power. The American economizer will be seen on exhibition at Madison Square Garden, New York, in May, as the firm has arranged for a working exhibit to be shown at that time

The Mason Telephone Pay Station company of Ludington, Mich., is now manufacturing automatic telephone pay stations especially for the independent field. These instruments, which were described in the Western Electrician of March 5, 1898, have been on the market for some time and a large number are now in use. It is claimed that they are giving entire satisfaction, as they are thoroughly reliable and fully guaranteed by the manufacturers. The Mason company is willing to ship one of these instruments on 30 days' trial to any responsible telephone company, and if not found satisfactory, it may be returned at the expense of the Mason company. It is suggested that independent telephone men who contemplate the use of automatic pay stations write the Mason company for descriptive catalogue and further particulars.

From all reports the Electrical Exchange of Chicago is doing an excellent and rapidly increasing business. The exchange has just shipped to the Alaska Transportation and Mining association of St. Michaels a complete electric-light plant, to be used on one of the company's steamboats running on the Yukon River. President T. S. Lane of the exchange states that his institution has also just secured the agency for the Upton Midget arc lamp, and that one of these lights will ornament the bow of the steamboat that plies up and down the Yukon. Incidentally it may be said that the Electrical Exchange has, particularly during the last week, done a remarkably fine business, complete electric-light plants having been sold to Shawneetown, Ill., and Dodgeville, Wis.

A very large amount of arc apparatus in the local electric-light stations of the country is being exchanged for new arc dynamos of more modern design and larger units. Many of the largest electric arc-light stations in the country have exchanged their small 25, 40, 50 and 60-light dynamos for modern arc dynamos of 100-lights capacity and upwards. The possibilities of operating an arc-light station more economically by such changes are very great. As an example the Virginia Electric company, a new corporation of Norfolk, Va., which is a consolidation of two competing electric-light companies, has just made a contract with the Brush Electric company by which the latter company takes in exchange for a modern equipment the following apparatus: Six 40-light and one 30-light Brush dynamos, five 50-light and one 30-light Thomson-Houston arc dynamos and three 50-light American arc dynamos, a total of 16 arc dynamos, with a very low efficiency as compared with the present machines; requiring 16 belts, 16 pulleys, 32 bearings, 32 oil-cups and a large amount of floor space which could be used to advantage for an increase of business, without mentioning the extra labor and attention required for the operation of these old dynamos. In place of these old machines the Virginia Electric company will now use only six 120-light 1,200 candle power Brush arc dynamos with an efficiency of at least 15 per cent. greater than the old dynamos and a corresponding amount of saving in coal, with self-oiling bearings requiring little if any attention and with a greater capacity in the number of lights. The voltage on the circuits with the old dynamos has not exceeded 2,500, while one of the large dynamos is rated at 6,000 volts, but with the use of the multi-circuit system of the Brush company there will be no change in the voltage on each circuit and no change whatever in the rearrangement of the lamps or the circuits themselves. Three circuits will be run from each dynamo to an 18-circuit switchboard, to which will be attached the old circuits exactly in their present condition. The advantage of the multi-circuit system is very great in such a case, because it does not necessitate a large expenditure, and the overhauling, rearrangement and practical rebuilding of the lines for a high voltage.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 12, 1898

602,142. Supply System for Electric Railways. Percival J. Pringle, London, England. Application filed October 27, 1896. Patented in England February 2, 1894.

A system of electric traction is proposed consisting of the combination of a rail forming the return circuit, an electrically propelled vehicle on the track having collectors attached which pick up the current from a series of surface plates or rails, a certain number of which form a block, and a shunt collector on the vehicle connected to the return rail through a resistance also carried on the vehicle, a main supply conductor from the source of electricity and conductors from distributers to the separate sections of a block, a series of distributers, one for each block of sections for successively connecting the current from the main supply to the separate sections in exact relationship with the movement of the car or vehicle.

602,172. Secondary Battery. Friedrich W. Schneider, Triberg, Germany. Application filed June 10, 1897.

The supporting frame consists of parallel perforated plates with the spacing tubes and connecting bolts, and the electrodes consist of perforated tubes containing active material, the tubes being piled in the spaces between the plates and resting upon the spacing tubes.

602,174. Telephone Transmitter. Herbert E. Shreeve, Boston, Mass. Application filed August 26, 1897.

This transmitter employs a vibratory diaphragm, front and back electrodes mounted thereon, the former being rigidly and the latter elastically attached thereto; with a variable resistance medium composed of substantially spherical or rounded carbon granules or particles, held between and in constant contact with the electrodes.

NO. 602,235.

602,176. Storage Battery. George A. Washburn, Cleveland, Ohio. Application filed May 22, 1897.

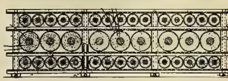
A storage battery electrode has on each side a series of groups of concentric ring-shaped projections of substantially uniform cross-section one with the other and equally spaced at all points to hold active material between them and standing out above the adjacent surface of the plate, and a hole centrally through each group communicating with the opposite side of the plate.

602,182. Dynamo for Electric Car-lighting Systems. Edwin J. Preston and Arthur B. Gill, London, England. Application filed February 25, 1895. Patented in England March 17, 1894, and November 25, 1895; in France January 17, 1895; in Belgium January 17, 1895; in Germany January 19, 1895; in Switzerland February 5, 1895; in Italy March 31, 1895; in Brazil April 24, 1895; in Austria April 30, 1895; in Canada October 3, 1895; in Hungary November 3, 1895; in Victoria December 7, 1895, and in India December 27, 1895.

The arrangement provides for a dynamo in one-sided suspension from the under side of the vehicle, with pulley-and-belt connection between the shaft of the dynamo and one of the vehicle axles, the belt being in about a horizontal direction, the dynamo acting as a tension device for the belt, and means for shifting the point of suspension of the dynamo and thereby altering the tension of the belt.

602,208. Electric Block System. Franz Burger, Fort Wayne, Ind. Application filed August 2, 1897.

With the leading and return conductors there are a series of insulated trolley sections, a series of section feeders, a normally closed switch for each section feeder located at the entrance of each trolley section and adapted to be engaged by the trolley, a connection between the switch and a rear trolley section, and a switch-operating magnet in the connection whereby when a car enters a section the corresponding magnet is energized to open the switch and break the circuit controlling the rear section, and when the trolley leaves the section and enters a succeeding section, the trolley operates the switch to restore it to its normal or closed position.



NO. 602,172.

602,212. Process of and Apparatus for Electro-depositing. Emile L. Dessolle, Epinay sur Seine, France. Application filed August 25, 1897.

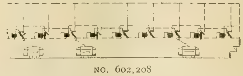
The process consists in first saturating the surface of a cathode which is of metal capable of occluding hydrogen with hydrogen, electro-coating the cathode with metal, and then stripping the deposit from the cathode.

602,218. Electric Transformer. Ludwig Gutmann, Pittsburg, Pa. Application filed October 31, 1890.

A core element for electric transformers consisting of a plate of magnetic material, two recesses or more provided in the plate for locating the transformer windings, polar projections caused by the recesses, and a second plate or strip of magnetic material interlocking with the polar projections of the plate named first.

602,235. Electric Cord-adjusting Device. Francis N. Lawton, Summit, N. J. Application filed April 5, 1897.

An adjusting device for flexible insulated conducting cords consisting of a metal wire, rod or form of metal having a smooth curved exterior surface, bent or crimped into a series of successive loops arranged in the same plane, has a layer or coating of insulating vitreous enamel thereon.



NO. 602,208

602,239. Aerial Railway. Martin A. de Palacio, Madrid, Spain. Application filed December 20, 1897. Patented in Spain July 6, 1895; in France August 22, 1895; in Belgium August 22, 1895; in Switzerland August 22, 1895; in Germany August 26, 1895, and in Sweden September 19, 1895.

An aerial railway is constructed with a line of rails of U form spliced end to end, a rack located in the throat of the U of the rail, one or more suspension cables, means for suspending the line of rails from the cables, and pillars for supporting at intervals the suspension cables and the line of rails which take between the pillars their respective curves of equilibrium.

602,302. Suspending Batteries on Carriages. Reginald T. D. Brougham and Walter C. Bersey, London, England. Application filed December 13, 1897.

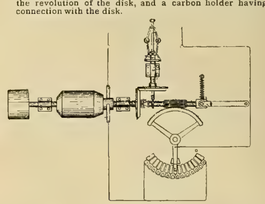
The combination of the carriage frame, a box, springs suspending the box from the frame and a rod pivoted at one end to the frame and at the other to the box, comprises one of the claims set forth.

602,325. System of Electrical Propulsion for Vessels. Jean J. Heilmann, Paris, France. Application filed December 3, 1895. Patented in Italy January 28, 1895; in India April 6, 1895; in Russia April 29, 1895; in Spain July 1, 1895; in Portugal July 19, 1895, and in Belgium October 22, 1895.

A steam engine drives two or more generating dynamos, having their armatures connected in multiple with the main conductors. There is a separately driven constant-potential exciting dynamo with which the field coils of the main dynamos are connected in multiple; a rheostat is in series with the exciter armature for varying the field strength of the dynamos; two or more electric motors are connected to the propeller shaft, having their field coils in series multiple with their armatures, and a reversing switch between the field coils and the armatures of the motors.

602,380. Electric Arc Lamp. Edgard Weber, Paris, France. Application filed September 11, 1897. Patented in France April 30, 1897 and in Austria July 6, 1897.

One claim covers the combination with a frame of an electro-magnet, a magnetic disk in the field of the magnet, a brake for the disk, an armature coacting with the magnet and controlling the brake, the magnet serving to retard the revolution of the disk, and a carbon holder having connection with the disk.



NO. 602,413.

602,404. Electric Arc Lamp. John Mueller, Cleveland, Ohio. Application filed August 27, 1897.

There is but one claim, which is as follows: In an arc lamp the combination with the carbon-holding devices and a feeding clamp having sliding engagement with the upper carbon holder, of a lifting lever adapted to engage and lift said clamp, a spring acting on said lever to cause it to engage said clamp, a cross lever pivoted on the lamp frame, auxiliary levers and thermo-expansive strips connecting the auxiliary levers respectively with the cross lever and the lifting lever, and with the cross lever and a binding post to which the main circuit is connected.

602,413. Automatic Device for Removing Resistance in Starting Electric Motors. George H. Whittingham, Baltimore, Md. Application filed September 9, 1897.

A resistance is included in the motor circuit normally or when at rest; a toothed resistance arm in engagement with the resistance; means are adapted to engage the toothed arm when starting the motor but disengaged therefrom when the motor is not running; a centrifugal governor serving to effect the engagement at the time of starting the motor, whereby the resistance is cut out; and means for returning the resistance arm to the point of greatest resistance when stopping the motor.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, APRIL 30, 1898. No. 18

Induction Motors in the Deering Works.

To see the largest and most interesting installation of induction motors in or near Chicago one must take a trip to the extensive works of the Deering Harvester company. If the visitor secures the necessary pass at the office, he may proceed among the yards and shops until he comes to the new twine mill, where he will find the object of his search. The stranger will be impressed with the size and activity of the works as he passes through them, and when he is told that over 5,000 men are employed in a plant covering 62 acres of ground he can readily believe the assertion. The works extend along the North Branch of the Chicago River, between Fullerton avenue and Diversey street, and transportation facilities are afforded by the Chicago, Milwaukee and St. Paul and Northwestern railroads and the river. There is also an intramural standard-gauge electric freight railway operated with double trolleys on a 220-volt all-metallic circuit. The product of the factories is the well-known Deering agricultural machinery and binder twine, and it is claimed that 14,000 carloads of raw material or finished product are yearly shipped in and out of the plant. Power for machine driving is generated in several large steam-engine plants scattered about the factories. An interesting feature of the shops is the extent to which labor-saving machines have been developed; the visitor is attracted by automatic devices of one sort or another at almost every turn. There are two steam-driven electric-light and power plants of large size. The newer one has been in operation about two months and forms the subject of this article. It is to be noted that the works are being constantly improved; they represent the growth and accretion of years; and as it is evident that the centralization of all power-generating units in one plant, with electrical transmission to the points of consumption, would result in marked economy of operation, it may be hoped that the improvement, too, is in contemplation.

The new electrical plant consists of a large three-phase generator which supplies current to incandescent lamps and a number of induction motors. It is a part of the equipment of the power house at the twine factory. This factory, with the new addition, is a very large one, turning out, it is said, over 30 miles of twine a minute. The twine is spun from manila and sisal fibers and wound into balls, which are packed in bales for shipment. The manila comes from the Phillipine Islands and the sisal is imported from Mexico and Central America. George L. Rice is the superintendent of this factory, and he takes an intelligent interest in the efficiency of the electric drive.

Only a portion of the machinery in the twine factory is operated by the motors; the greater part is driven by direct belting and shafting from the great 2,000 horse power Corliss engine, which was the most conspicuous feature of the power house of the Intramural railway at the World's Fair. This engine was sold to the Deering company after the exposition and remodeled for belt driving.

The engine-dynamo which supplies the current for the three-phase electrical plant is shown in Fig. 1. The engine is of the cross-compound condensing type, with Corliss valve gear, and was built by the Allis company. Its dimensions are: Stroke, 48 inches; cylinders, 24 and 50 inches. It is rated at about 1,100 horse power. Directly connected to this engine, as shown in the picture, is a General Electric three-phase alternator. This generator is a 600-volt, 40-cycle, 750-kilowatt machine. It has 48 poles and is operated at 100 revolutions a minute. The field magnets are revolved within the armature, which is the stationary part. A 15 kilowatt, 125-volt exciter is belted to the main engine shaft on the side of the flywheel away from the spectator in the picture.

Blue Vermont marble is used for the handsome switchboard, which is shown at some distance and rather indistinctly in Fig. 1. This board is made up of eight panels—one for the generator and seven for motor feeders—on the principle of a railway switchboard. The number of motor panels is characteristic of the thoroughness and carefulness which is shown throughout in the construction of this plant. Each motor or group of motors, as the case may be, in the factory or in the adjacent warehouse or foundry, is wired on a distinct circuit from the board and can be, and often is, started up directly from the engine room. The possibility of doing this also shows the advantage of the absence of external resistance in starting the motors. Beside the necessary switches, the generator panel is equipped with the General Electric inclined-coil measuring instruments and I-T-E circuit breakers, while the feeder panels have each a Thomson recording wattmeter and an outfit of aluminum fuses. These fuses are used because so little material is needed to carry the current. When they "blow"

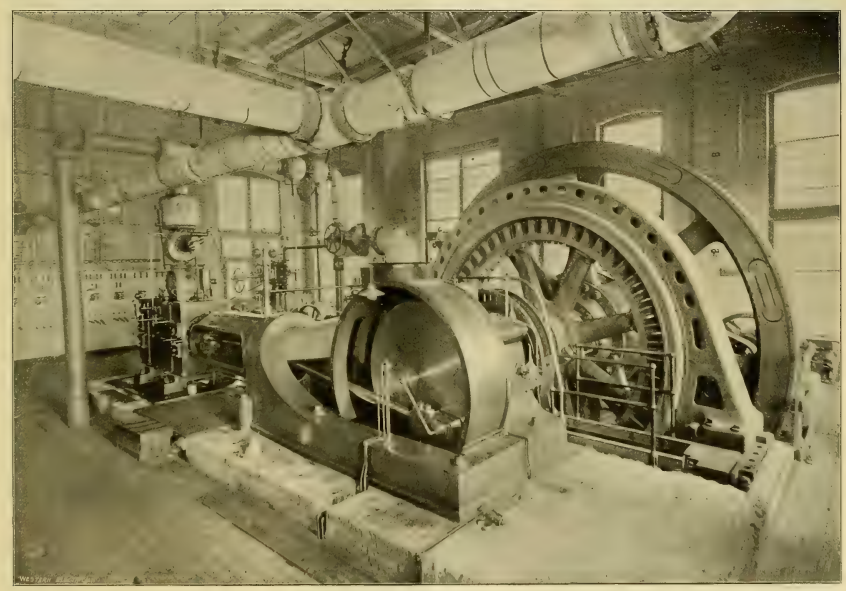


FIG. 1. INDUCTION MOTORS IN THE DEERING WORKS—THREE-PHASE GENERATING PLANT.

they are dissipated into powder; there is a puff and the fuse is gone without a mass of melted metal.

In Fig 2 on the next page is illustrated one of the side walls of the new part of the twine factory, showing the wiring from the three-phase plant and a bank of three transformers. The transformers, it should be understood, are used only in the lighting circuits; the motors are operated at the generator voltage. The stack shown at the left in this picture is that of the power plant of the twine mill.

The transmission lines are all aerial and are comparatively short for alternating systems of transmission, the greater part of the power being consumed within a radius of 1,000 feet of the generating plant; however, a comparatively small amount of current is transmitted to the lower end of the factory yards, something over one half mile distant. The larger portion of the feeders are run on the delta or triangular form of construction, thereby carrying a theoretical feature into actual practice, making the three-phase wires as nearly equidistant as possible. This was done in order to give the lines the benefit of any reduced inductive effect that might accrue from such a formation. Stranded flexible cables are used, not only as tending to make preferable con

struction, but to again react on the inductive effect of the alternating transmission.

As the greater part of the load on the generator is induction motors with the remainder in incandescent lights, the question of regulation as affecting the lighting system was a problem of much interest. In order that the variation in lamp voltage should be reduced to a minimum under changes of motor load (although the engine regulation is very close) the twine mill proper was wired on

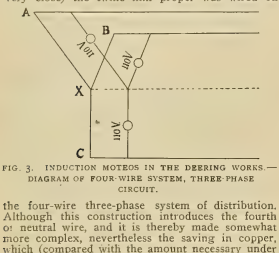


FIG. 3. INDUCTION MOTEOS IN THE DEERING WORKS.—DIAGRAM OF FOUR-WIRE SYSTEM, THREE-PHASE CIRCUIT.

the four-wire three-phase system of distribution. Although this construction introduces the fourth or neutral wire, and it is thereby made somewhat more complex, nevertheless the saving in copper, which (compared with the amount necessary under similar conditions for two-wire direct or single-phase alternating) is as 1-3 to 1, and the balance thus obtained more than compensates for the extra construction. Very little effect in lamp voltage is noticeable under sudden and varying changes of motor load. The ratio of conversion for incandescent lighting is 600 to 110 volts.

The four-wire three-phase system of distribution is illustrated by the star diagram (Fig. 3). A, B and C are the main three-phase lines and X the fourth or neutral wire. While motors of the proper

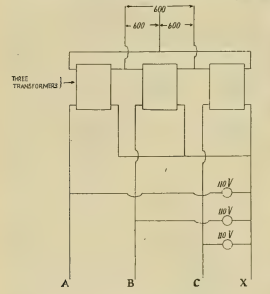


FIG 4 INDUCTION MOTORS IN THE DEERING WORKS — TRANSFORMER CONNECTIONS FOR LIGHTING CIRCUITS.

voltage could be used directly from this system, connected to the three main lines, this distribution is left to the lighting alone. Fig. 4 is a diagram of the transformer connections as actually made to carry out the scheme. The delta formation is used on the primaries and the star or "Y" formation on the secondaries. The lighting distribution is so arranged that in case of emergency, or when the three-phase power generator is shut down, power for lighting can be delivered from the single-phase alternating system of the company's old power sta-

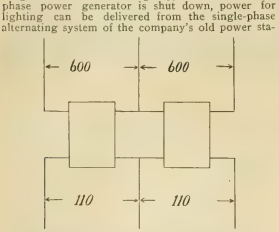


FIG 5. INDUCTION MOTORS IN THE DEERING WORKS.—TRANSFORMER CONNECTIONS FOR LIGHTING CIRCUITS.

tion over the entire network of the mills. For emergency work, repairs and the like, a 110-volt direct-current Edison dynamo can be thrown on to the system if desired. This arrangement necessitates, for the sake of flexibility and the surety of light under all conditions, that the neutral or X wire be increased in size to conform with two-wire direct or single-phase alternating conditions.

In other buildings lighted from the three-phase plant two transformers are connected as shown diagrammatically in Fig. 5, and the Edison three-wire distribution carried out on the secondaries; in other cases transformers are connected across two of the three-phase lines as in single-phase distribution.

Molding has been used on the interior wiring construction for lighting, and all cut-outs and switches are placed in asbestos-lined cabinet boxes. The interior motor circuits are open construction, and D. & W. enclosed fuses are used. The construction was planned and executed by Mr. F. L. Stevenson, the Deering company's electrician.

All motors used in this installation are of the induction type made by the General Electric company. They are ironclad, very symmetrical in design and of the best mechanical construction. They have no brushes, of course, and are started without external resistance by simply throwing a switch. They need very little attention and seem to be as effective in operation as they are beautiful in appearance. The following tabulated statement shows the number and size of motors operated from the three-phase generator:

No. of motors.	Capacity of each in H. P.	Used to Drive—
1	20	Freight elevator in warehouse.
1	30	Freight elevator in warehouse.
8	75	Twine machines.
1	50	Foundry blower.
1	50	Machinery in malleable iron-works.
1	75	Machinery in malleable iron-works.
1	50	Machinery in cutter-bar department.

In addition another 75 horse power motor has just been ordered, but not set up. This makes a total of 15 motors, having an aggregate capacity of 950 horse power. All of these motors are in or near the twine mill, with the exception of the one in the cutter-bar department, which is over half-a-mile away.

Two of the 75 horse power motors are shown in Fig. 6 (page 251) attached to the wall of one of the long spinning rooms in the twine mill. There is another motor of like capacity in this room, not

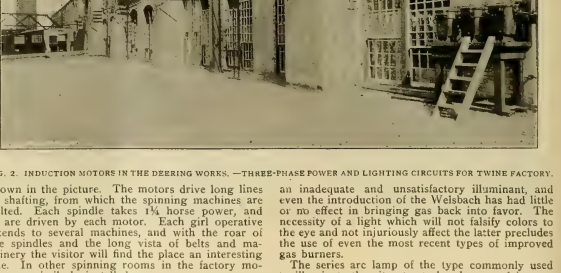


FIG. 2. INDUCTION MOTORS IN THE DEERING WORKS. —THREE-PHASE POWER AND LIGHTING CIRCUITS FOR TWINE FACTORY.

shown in the picture. The motors drive long lines of shafting, from which the spinning machines are belted. Each spindle takes 1¼ horse power, and 6c are driven by each motor. Each girl operative attends to several machines, and with the roar of the spindles and the long vista of belts and machinery the visitor will find the place an interesting one. In other spinning rooms in the factory motors are similarly installed.

The view in Fig. 7 was taken in the room where the twine is wound in balls. Two 75 horse power motors are here placed near together and fastened to the ceiling. They drive shafting from which 168 baller spindles are operated. This picture shows also the open wiring of the motor circuits and the iron box at the bottom of the service board containing the oil-immersed switch. With these switches, enclosed fuses and brushless motors, it is impossible to draw a spark in any part of the motor plant. This is of the highest importance in a factory like this twine mill, full of inflammable material. Indeed, the fact that they had no brushes, commutators or sparks was one of the greatest recommendations of the induction motors for the Deering company's use. Every precaution is taken against fire in all parts of the building, and it is felt that there is no danger from the electrical plant.

Several of the motors are used to drive machinery outside of the twine factory, as shown by the table previously given. One of these is illustrated by Fig. 8. It is a 50 horse power machine placed on a balcony in a foundry and it drives a No. 8 Sturtevant blower at 2,200 revolutions per minute. The motor turns at 600 revolutions per minute and is belted to a jackshaft. The blower supplies the blast for two furnaces used in the foundry for malleable-iron castings.

It will be noticed that in Figs. 6, 7 and 8 the motors are attached in three different positions—from the side, from the top and at the bottom. The mechanical design of the motor allows this to be easily accomplished by adjusting the frame so that the oil feeders are in the proper position. Moreover, by introducing the armature on the one side or the other, the pulley can be had on either side. The motors have eight poles and are operated at from 550 to 600 volts. They are spoken of with enthusiasm by the men in charge of the plant, who say they need no more attention than any part of the shafting. Oilers go over the shafts once a week and they give the motors all the care they get.

About 1,900 incandescent lamps are supplied with current from the three-phase generators—1,500 in the twine mill and warehouse and 400 in the foundry. The General Electric company's type H transformers are used, and they have from 80 to 150 lights' capacity each.

The plant is operated at full load, and seems to be doing its work remarkably well. It cost the Deering company probably 20 per cent. more than a direct-current outfit would have done, but it fulfills conditions that could hardly have been met by any other system, and is considered to be well worth the additional cost.

Enclosed Arcs for Mill Lighting.

Textile manufacturers throughout the country for many years have been carrying on experiments in their endeavor to secure an artificial light which would enable their operatives to work with the same facility as in actual daylight, and to produce material in the dark winter days not less perfect than that made in the full light of summer. Gas has long been discarded by the progressive manufacturer as an inadequate and unsatisfactory illuminant, and even the introduction of the Welsbach has had little or no effect in bringing gas back into favor. The necessity of a light which will not falsify colors to the eye and not injuriously affect the latter precludes the use of even the most recent types of improved gas burners.

The series arc lamp of the type commonly used to illuminate the city streets has been, and is even now, in use in many mills. This lamp, with a clear globe, as generally used, has been found too glaring and penetrating, and, while giving a large quantity of light, has proved inconvenient and unsuitable on account of the uneven diffusion of the light, the creation of heavy shadows and the necessity of changing the carbons daily. The inverted arc lamp with the inverted umbrella-shaped reflector has also been tried, and, while the results have been fair, the combination of the large reflector and the lamp is cumbersome and objectionable in appearance, while the necessity of keeping walls and ceilings constantly white is expensive.

The advent of the enclosed arc lamp has, for the first time, given the textile manufacturer a means of illumination which overcomes almost all the different objections and is peculiarly adapted for all classes of mill work. Arc lamps of this type were first developed for direct current and have come largely into use. They have recently been perfected by the General Electric company for use on alternating-current circuits also, and may, therefore, be used either in mills already furnished with their own

direct-current or alternating-current dynamos or taking electricity from systems used to light the city streets.

Enclosed arc lamps have already proved satisfactory illuminants in mill rooms, where spooling skeining, sorting and other delicate work is carried on, as well as in the stock-rooms, dye-houses, etc. The quality and intensity of the light for different requirements and classes of work being susceptible

FIG. 6. INDUCTION MOTORS IN THE DEERING WORKS.—ELECTRIC DRIVE IN SPINNING ROOM. TWINE FACTORY.

of regulation and variation by the use of different translucent globes, an almost ideal light is obtainable, as nearly like that of day as is possible with artificial light. The light from the arc, instead of being concentrated and glaring, is perfectly diffused, eliminating all heavy shadows and allowing of results which could not be obtained by any other artificial means of illumination.

The advantages which the enclosed arc lamp offers will readily be appreciated by the mill owners and mill operators. The carbons burn for a long time; a small number only is required, and the labor of trimming is very small. It is not necessary, therefore, to have a special man occupied solely in trimming arc lamps during the day.

The direct-current enclosed arc lamp burns for about 150 hours with one trimming, that for alternating current about 100 hours. In certain mills, where these lamps have been installed the light is seldom used in summer, and in winter only a few hours daily; under these conditions recarbonizing is necessary only about twice a year, while the cost of carbons is about five cents. Of course, in other mills, where artificial light is necessary for longer periods during dark days or into the night, recarbonizing is necessarily more frequent, but compared with open arc lamps the cost of attendance is very small, while that for carbons shows a marked economy. With open arc lamps a large amount of carbon dust collects in the globe. When the globe is cleaned or dusted out by the trimmer the dust usually settles over everything that may be in the vicinity. With the enclosed arc lamp there is little or no dust, the combustion being almost perfect and any that may be is collected in the small receptacle and held, as it were, in a bottle, to be emptied where it cannot settle on any material or into machinery.

BOOK TABLE.

A very handsome volume is that on "Modern Switchboards" issued in gilt-stamped cloth boards by the Cutter Electrical and Manufacturing company of Philadelphia. It is printed on fine, heavy paper in large type, with wide margins, on pages 9 by 11 inches. The illustrations are beautiful, and several colored plates are very striking. Mr. Albert B. Herrick is the compiler of the work, and acknowledgments are made to Mr Luther Stieringer and Mr. W. H. Tapley. The book treats of general switchboard construction and all kinds of switchboard appliances and protective devices. The types of standard and special switchboards, such as railway, alternating, low tension and the like, are considered in several chapters. Especial attention is paid to the Cutter D. E. circuit breaker, and there are 60 pages of instructions and data included the object of concern interested in switchboard work. The book is one that will be preserved in the engineers' library.

Street-railway Litigation.

An important legal question has been raised in the proceedings instituted by Montgomery Ward & Co. of Chicago against the Chicago City Railway company to restrain the latter from erecting poles and wires in Michigan avenue between Madison and Randolph streets.

It will be recalled that when the City Council passed the order providing for the elevation of steam-railroad tracks at Sixteenth street, the mayor was authorized to grant the Chicago City Railway company permission to establish trolley lines temporarily on State street and Wabash avenue north of Twenty-second street, with the necessary loops, to enable the company to bring Clark street trolley cars into the heart of the business district. The cable cars to haul them. It is admitted that such an arrangement would be impracticable if all the trolley cars now operating on Clark street should be carried over to the Wabash avenue loop.

The street-railway company has therefore endeavored to have set aside the injunction granted in the Superior Court of Cook County, and the case is now in the Appellate Court of Illinois, First District. Following is an abstract from the brief filed by the appellant:

"Complainants allege they are the owners of certain lots abutting upon Michigan avenue, north of Madison street, in the northwest fractional quarter of section 10, known as Fort Dearborn Addition to the city of Chicago; that these lots 'front east upon Michigan avenue and Lake Park;' that the land 'known as Michigan avenue and Lake Park,'

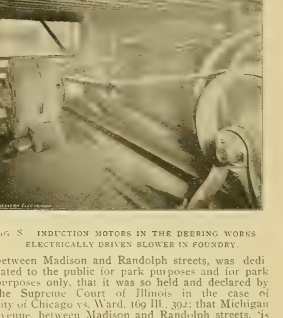


FIG. 8. INDUCTION MOTORS IN THE DEERING WORKS ELECTRICALLY DRIVEN BLOWER IN FOUNDRY.

between Madison and Randolph streets, was dedicated to the public for park purposes and for park purposes only, that it was so held and declared by the Supreme Court of Illinois in the case of city of Chicago vs. Ward, 169 Ill. 392; that Michigan avenue, between Madison and Randolph streets, 'is a part and parcel of said Lake Park, which Lake Park between the east line of said lots and Lake Michigan was dedicated to the use of the public by the government of the United States, not to be occupied with buildings of any description;' that the Supreme Court also held in the Ward case that no encroachments should be made upon said land by any railroad company; that the Chicago City Railway company now operates a street railway upon Michigan avenue, between Madison and Randolph streets, by means of an underground cable,

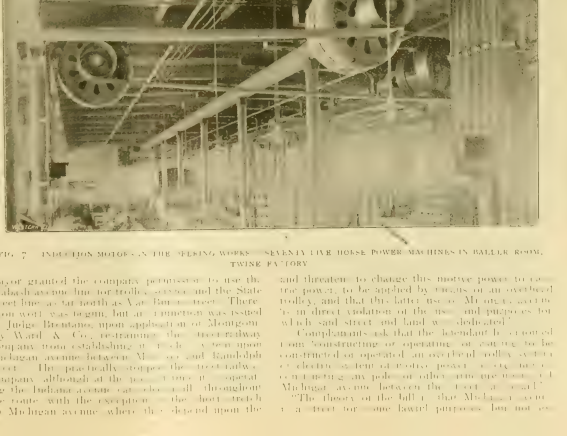


FIG. 7. INDUCTION MOTORS IN THE TWINING WORKS.—SEVENTY-FIVE HORSE POWER MACHINES IN BALLER ROOM, TWINE FACTORY.

[illegible] granted the company permission to use the Wabash avenue line for trolley cars, and the State street line as far south as Van Buren street. There upon work was begun, but an injunction was issued by Judge Brentano, upon application of Montgomery Ward & Co., restraining the street-railway company from establishing a track upon Michigan avenue between Madison and Randolph street. The practically compose the [illegible] complaint, although of the [illegible] upon the ground that the [illegible] ing the Indiana avenue cars [illegible] all throughout the route with the exception of the short stretch on Michigan avenue where they desired upon the and threatened to change this motive power to electric power, to be applied by means of an overhead trolley, and that the latter use of the [illegible] is in direct violation of the uses and purposes for which said street and land were dedicated.

Complainants ask that the defendant be enjoined from 'constructing or operating or causing to be constructed or operated an overhead trolley system of electric railway or electric power system for propelling any passenger or other cars upon said Michigan avenue between the [illegible] a street for [illegible] purposes [illegible]

all lawful purposes; that it is a street in so far that the defendant may operate thereon a street railway by cable power but not by electric power; that while it may be used in fact as a street, that in law it is not a street, but is in some undefined way a park or a portion of a park, and that because the courts have enjoined the Illinois Central Railroad company from making any encroachment west of its west line of right-of-way that therefore these cases, or some language by the courts, operate as a limitation upon the full exercise of the power vested in the municipal corporation of Chicago, to manage, control and use Michigan avenue for all the lawful purposes of a street or highway.

"On behalf of the appellant it is insisted that the court below erred in entering the order for an injunction, because the bill upon its face discloses the fact that Michigan avenue is a public street and is therefore subject to the absolute control of the municipal authorities, and, further, that the purpose for which defendant intended to enter upon the street was a lawful purpose, and hence the complainants have no standing in a court of equity."

In the argument supporting the right of the city government to exercise police powers over Michigan avenue, it is contended that the abutting property owners, by their acts, have recognized the original dedication of Michigan avenue as a street, and that they are now estopped from a denial of the right of the public to enjoy what was thus dedicated. It is shown by the records that "shortly after the property owners, under authority of the City Council, established the east line of the street, and after it was in use by the public from Twelfth street north to the government reserve line, north of South Water street, it was insisted by these property owners that, by the plat of 1829, Michigan avenue was dedicated as a street throughout the entire length of Fort Dearborn addition, and they petitioned the City Council to open such street from the reserve line north to the river."

Attention is called to the fact that the property owners aided in reducing the width of Michigan avenue from 120 feet to 90 feet, and this is cited as clear recognition by them of the street, and it is contended that no reason can be assigned for this action other than that they considered the street as independent of the park. Their solicitude was with reference to the open space beyond the street. It was not the street which enhanced the value of their lots, but the open space beyond. The larger space across the street, the greater area there, was the advantage the lot owners were seeking, because it was this space they understood should remain free from buildings.

The argument in behalf of the street-railway company is summarized as follows: "The bill in this case does not disclose any violation of the trust declared by the original dedication of the public ground in Fort Dearborn addition, nor that any special trust in favor of the lot owners was created by that dedication. It does not negative the legal effect of the acts and conduct of the property owners as set forth in the several cases cited. There is no allegation that Michigan avenue is not a public street, and that it has been so used by the public with the consent of the property owners, and acquiescence of the municipality and state. It is not denied that the appellant company is now in lawful occupation of the street, or that the use of the street by a street-railway company is lawful. No facts are stated from which it appears that the appellant is about to enter upon the street without lawful permission from the municipal authorities or that the purpose of such entry is unlawful. No special injury or damage is shown, and no other equitable ground of relief is set up.

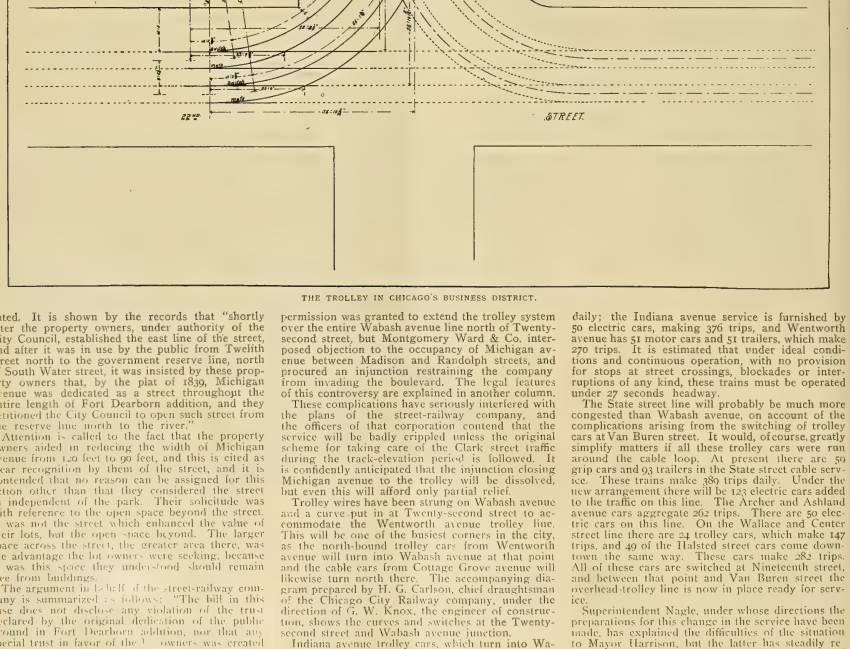
"It is admitted that the appellant may operate a street railway by cable power on this street, but it is denied that it can operate such railway by electric power."

The Trolley in Chicago's Business District.

Everything is in readiness for the operation of electric cars on the State street and Wabash avenue cable lines of the Chicago City Railway company north of Twenty-second street. The mayor has granted permission to place wires and poles in State street, between Twenty-second street and Van Buren, but he has refused to let the trolley lines extend farther north on State street. However, they are hauled or pushed by the cable cars from Madison street north two blocks, where they turn west into Randolph street and secure connection with the trolley for the return trip.

Should the mayor adhere to his policy regarding State street the company will be obliged to turn its trolley cars into Van Buren street and use that street for a switching terminal, as State street is too important a thoroughfare to be blocked in this manner. This plan is very satisfactory to the big department stores that occupy the west side of State street at that point, as it will bring to their doors all the passengers from the southwestern section of the city that now patronize the Clark street line. It will undoubtedly be a considerable surprise to many to learn that the trolley cars that will be brought to this point carry 85,000 paying passengers per day, more than twice the number carried on the State street cable line.

One of the most difficult tasks in connection with the change of route of the trolley cars is the arrangement of a time card. All the cars of the South Side system are run on schedule time, and every detail is carefully considered before any change is attempted. A great many factors must be considered in preparing such a schedule, otherwise all would be confusion. Provision must be made for operating 388 cars on the Wabash avenue loop. There are 86 grip cars and 150 trailers on the Cottage Grove avenue line, making 502 trips daily; the Indiana avenue service is furnished by 50 electric cars, making 376 trips, and Wentworth avenue has 51 motor cars and 51 trailers, which make 270 trips. It is estimated that under ideal conditions and continuous operation, with no provision for stops at street crossings, blockades or interruptions of any kind, these trains must be operated under 27 seconds headway.



THE TROLLEY IN CHICAGO'S BUSINESS DISTRICT.

The State street line will probably be much more congested than Wabash avenue, on account of the complications arising from the switching of trolley cars at Van Buren street. It would, of course, greatly simplify matters if all these trolley cars were run around the cable loop. At present there are 59 grip cars and 93 trailers in the State street cable service. These trains make 389 trips daily. Under the new arrangement there will be 123 electric cars added to the traffic on this line. The Archer and Ashland avenue cars aggregate 262 trips. There are 50 electric cars on this line. On the Wallace and Center street line there are 24 trolley cars, which make 147 trips, and 49 of the Halsted street cars come downtown the same way. These cars make 282 trips. All of these cars are switched at Nineteenth street, and between that point and Van Buren street the overhead-trolley line is now in place ready for service.

Superintendent Nagle, under whose directions the preparations for this change in the service have been made, has explained the difficulties of the situation to Mayor Harrison, but the latter has steadily refused to give his consent to the establishment of a trolley loop on the State street cable line.

permission was granted to extend the trolley system over the entire Wabash avenue line north of Twenty-second street, but Montgomery Ward & Co. interposed objection to the occupancy of Michigan avenue between Madison and Randolph streets, and procured an injunction restraining the company from invading the boulevard. The legal features of this controversy are explained in another column.

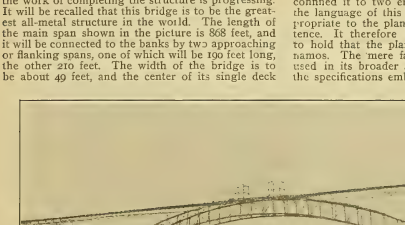
These complications have seriously interfered with the plans of the street-railway company, and the officers of that corporation contend that the service will be badly crippled unless the original scheme for taking care of the Clark street traffic during the track-elevation period is followed. It is confidently anticipated that the injunction closing Michigan avenue to the trolley will be dissolved, but even this will afford only partial relief.

Trolley wires have been strung on Wabash avenue and a curve put in at Twenty-second street to accommodate the Wentworth avenue trolley line. This will be one of the busiest corners in the city, as the north-bound trolley cars from Wentworth avenue will turn into Wabash avenue at that point and the cable cars from Cottage Grove avenue will likewise turn north there. The accompanying diagram prepared by H. G. Carlson, chief draughtsman of the Chicago City Railway company, under the direction of G. W. Knox, the engineer of construction, shows the curves and switches at the Twenty-second street and Wabash avenue junction.

Indiana avenue trolley cars, which turn into Wabash avenue at Eighteenth street, are now operated electrically, excepting on Michigan avenue, where

Trolley Road Crossing Niagara Gorge.

The main span of the new steel arch bridge across the gorge at Niagara Falls has been sprung, and the work of completing the structure is progressing. It will be recalled that this bridge is to be the greatest all-metal structure in the world. The length of the main span shown in the picture is 868 feet, and it will be connected to the banks by two approaching or flanking spans, one of which will be 190 feet long, the other 210 feet. The width of the bridge is to be about 49 feet, and the center of its single deck



TROLLEY ROAD CROSSING NIAGARA GORGE.

will be taken up by double tracks for an electric-road service across the river. There will also be carriageways and footpaths.

The work of erecting this great arch has been most interesting. The top chords of the shore spans were sent out along the suspension bridge, which the arch is to supplant; the end posts were erected, and then piece by piece the wonderful arch grew out from both sides at the same time until the two sections met and were joined in the center of the river high over midstream. As every two sections of the arch were placed strong anchors were sent down to them from the top chord to sustain their weight, the picture showing these anchor cables very clearly. The arch is expected to be completed during the summer, and it will rank high as an engineering feat.

Rubber Companies Consolidate.

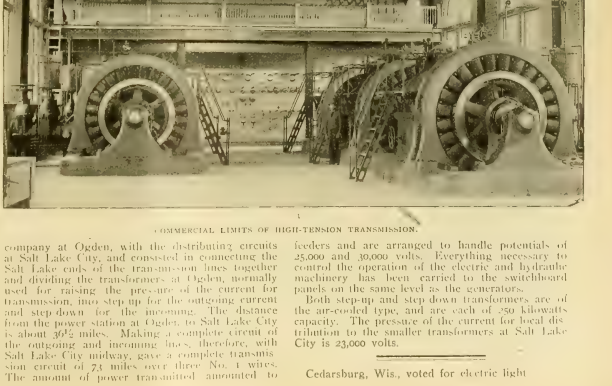
By the recent incorporation at Albany of the American Hard Rubber company of New York city, with a capital of $2,500,000, the Butler Hard Rubber and the India Rubber companies of New York and the Goodrich Hard Rubber company of Ohio go out of existence. The headquarters of the new company will be in New York, and the directors are Fritz Achelis, Richard Butler, Charles A. Hoyt, Edwin W. Belcher, Jr., Albert T. Morse, William W. Welting and Frederic G. Dow of New York and George T. Perkins and Henry C. Carson of Akron, O. Its only rival will be the Goodyear Vulcanite company of Pennsylvania. The new company is said not to be a trust, as the companies which cease to exist as corporations sell out and lose their identity in absolute consolidation. The fusion came of the conviction that it would be admirable business policy for the majority of the hard-rubber interests to work to one end in a corporate fusion. The American company will confine its manufacture wholly to hard rubber, and its products will be principally combs and appliances for electricity.

Very Limited Definition of "Plant" Upheld.

The specifications in an installation contract were divided into various subdivisions, such as "plant," "engines," "dynamos," etc. One of these subdivisions was: "Plant: The plant shall consist of two engines and two dynamos," with certain other provisions. This gave rise to the question as to what the term "plant" so used covered. It was contended, on the one hand, that this contract meant a plant as defined by Houston's Electrical Dictionary: "Plant—a word sometimes used for installation, or for the apparatus to carry on any manufacturing operation. An electric plant includes the steam engines or other motors, the generating dynamo or dynamos, the lamps and other electro-receptive devices, and the circuit connected therewith." But the Supreme Court of Michigan says, March 15, 1898 (Fisher Electric company against Bath Iron Works), that the parties had, in the subdivision of the contract, seen fit to define the plant to which the provisions of the subdivision applied, and had confined it to two engines and two dynamos. All the language of this subdivision was peculiarly appropriate to the plant as described in the first sentence. It therefore maintains that it was correct to hold that the plant meant the engines and dynamos. The mere fact that the term "plant" was used in its broader sense in other subdivisions of the specifications embraced in the contract, the Supreme Court declares, did not affect the construction of the term as restricted by the subdivision in question. This decision furnishes a hint of the care that should be exercised in drawing contracts.

Commercial Limits of High-tension Transmission.

An interesting experiment in high-voltage, long-distance, electric-power transmission was recently made at Ogden, Utah, in order to ascertain the limits within which high-voltage currents might be used commercially. The experiment was made by F. O. Blackwell of the General Electric company over the lines which connected the power station of what was, until recently, the Pioneer Electric company at Ogden, with the distributing circuits at Salt Lake City, and consisted in connecting the Salt Lake ends of the transmission lines together and dividing the transformers at Ogden, normally used for raising the pressure of the current for transmission, into step up for the outgoing current and step down for the incoming. The distance from the power station at Ogden to Salt Lake City is about 36½ miles. Making a complete circuit of the outgoing and incoming lines, therefore, with Salt Lake City midway, gave a complete transmission circuit of 73 miles over three No. 1 wires. The amount of power transmitted amounted to 1,000 horse power, and the voltage at which the transmission was effected reached at times as high as 30,000 volts. The current on the return was delivered to resistance vats at the power house, consisting of three wooden tanks.



COMMERCIAL LIMITS OF HIGH-TENSION TRANSMISSION.

By careful and repeated measurement with wattmeters at both ends Mr. Blackwell ascertained that this power was transmitted with the loss of only nine per cent., including four per cent. loss in the two sets of transformers. The drop in pressure due to inductance was practically nil, the capacity of the line being sufficient to compensate for reactance loss.

Continuing the experiment, part of the Salt Lake City station load was run from Ogden, with current at 24,000 volts. This was supplied to about 500 horse power in synchronous motors and lights for two days, under most severe climatic conditions—rain, fog and snow alternating. In addition a severe thunderstorm prevailed all through the night, the lightning arresters discharging repeatedly. Notwithstanding the severity of the conditions under which the test was made, the motors operated without failure and the lights burned without flickering, even during the times of lightning discharges. Not the slightest difficulty of any kind developed while this experiment lasted.

By the recent accomplishment of a scheme of consolidation all the electrical plants in Salt Lake City, as well as the transmission plants, supplying current from it to the outside, have been merged into the Union Light and Power company. The companies thus consolidated were the Pioneer Electric Power company, the Salt Lake and Ogden Gas and Electric company, the Big Cottonwood Power company, the Little Cottonwood Power company, the Citizens' Electric Light company and certain smaller interests.

The plant of the Pioneer Electric Power company is one of the most important installations in the West and the transmission one of the longest. The power house is located a short distance from the mouth of the Ogden Canon. The power is derived from the Ogden River, the water being brought to the power house through a wooden-stave pipe and riveted steel-pipe line, about 32,000 feet long. The electric plant consists of five General Electric three-phase alternators—24-pole machines running at 300 revolutions, and delivering 750 kilowatts each at 2,300 volts and 60 cycles. The complete plant is designed for 10 units, or a total output of 10,000 horse power. The exciters are General Electric six-pole, 500-volt kilowatt dynamos, each of ample capacity to excite 10 generators. Each alternator is directly connected to a Knight water-wheel of 1,200 horse power capacity, and each exciter to one of 135 horse power capacity.

The current is fed into the transmission lines from the step-up transformers at 16,100 volts, and delivered to the step-down transformers at 13,800 volts. They are ordinarily connected in delta, but can also be connected in "Y" to raise the potential to 25,000 volts whenever it is desired to run at the higher potential in order to increase the capacity of the line or the distance over which the power is to be carried. The switchboard panels on the gallery at the end of the power house are for the outgoing feeders and are arranged to handle potentials of 25,000 and 30,000 volts. Everything necessary to control the operation of the electric and hydraulic machinery has been carried to the switchboard panels on the same level as the generators.

Both step-up and step down transformers are of the air-cooled type, and are each of 250 kilowatts capacity. The pressure of the current for local distribution to the smaller transformers at Salt Lake City is 23,000 volts.

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The solution of the Hawaiian problem may yet be found in the present Spanish complications. Although it seems to be understood that the islands have not been annexed by the United States, it is not at all certain that such a plan will not be adopted. At any time it may be determined that that important group is necessary to the safety of this country, and if the United States once takes possession the establishment of cable communication between Honolulu and Washington must necessarily follow.

The foreign business of American electrical manufacturers has made remarkable advancement of late and is attracting the attention of European countries. The English Consular Bureau has made a report to the effect that the principal imports of machinery into British Guiana are from the United States, and that they are mostly in connection with the installation of electric-light plants. Special legislation is proposed by the French Chamber of Deputies for the increase of the tariff duties that have been in force since 1892. Several measures are now under consideration which, if enacted, might seriously affect trade between this country and France. For instance, the maximum tariff on electrical accumulators would be increased from $3.28 to $4.05, and the minimum duty from $2.50 to $3.18 per 100 kilogrammes. It is also proposed to impose a heavier tax on motor cars imported from this country, as American types are the only ones which offer serious competition to the French product.

Representatives of the Northwestern Electrical association are now in the East completing arrangements for the attendance of several prominent electrical men at the summer convention which is to be held in June, immediately after the annual meeting of the National Electric Light association at Chicago. The organization has extended invitations to Edison, Tesla, Thomson, Brush, Stanley and Wood, as representatives of the inventors who have contributed to the success of the electric-lighting and power industry. The city officials of Duluth and West Superior have also issued invitations to the same gentlemen, and it is believed by the committee that they will accept the hospitality of the association and the cities mentioned. During the convention many practical topics will be discussed by men of ability and recognized standing in the profession, and the gathering is expected to be one of the most profitable as well as the most entertaining that has yet been held by this progressive organization.

When the trolley line between Buffalo and Niagara Falls was established an arrangement was made by which the cars of this system were permitted to enter Buffalo on the tracks of the local street-railway company. The plan did not affect the regular service in any way, but proved a great convenience to the patrons of the Niagara Falls-Buffalo line, who otherwise would have been compelled to change cars at the city limits. Many patrons of the Buffalo system insisted upon riding upon the cars of the Niagara Falls-Buffalo line, and frequently presented transfers, which of course were not accepted. The annoyance to the street-railway companies as well as to the dissatisfied patrons led to consideration of the subject by the city law department. The corporation counsel has prepared an opinion in which he sustains the position of the street-railway companies. He says as long as a sufficient number of cars are operated by the Buffalo company to accommodate the patrons of the local system there is no ground for complaint and that corporations of this character have the right to make reasonable rules and regulations. He believes the arrangement complained of is a reasonable rule from a legal standpoint, and accordingly determines that the company is acting within its powers in enforcing its regulations.

The success which has attended the efforts of American engineers in Great Britain has attracted even greater attention in Europe than in this country and has encouraged many to seek assistance through similar channels in developing electrical industries on the Continent where the natives have neglected the natural advantages, particularly in power transmission. There seems to be a lively interest in the subject just now in Italy, where many villages have made use of water power for the operation of electric-light plants. But this has not been done in many instances, and it is pointed out that good opportunities are presented. For instance, the town of Amalfia, which is a favorite resort of travelers in the winter season, is furnished with excellent hotels, and has a torrent of water running right through it which works numerous paper mills and several macaroni factories. According to local authorities, to install an electric-light system there would be neither costly nor difficult, and it is believed that it would pay handsomely on the investment, as the large hotels alone would guarantee remunerative returns. In Naples, which is supplied with a continuous current at 110 volts, German lamps are used, of very inferior quality both in the color of the globes, the finish and light-dispensing power. It has been suggested that American manufacturers, by encouraging American engineers, might open up an excellent market for electrical supplies of all kinds as well as heavy machinery throughout Europe. At the present time American methods are in favor, American engineers are in demand, and it is but natural to suppose that American goods would find ready sale if properly pushed in these markets.

Mention has already been made of the decision by the United States Circuit Court of Appeals in the case of the city of Richmond against the Southern Bell Telephone and Telegraph company. The opinion construes the words "telegraph companies," as used in the act of Congress of 1866, to include telephone companies. It contends that the telegraph and telephone both communicate messages by means of electricity over wires, for longer or shorter distances. The telegraph communicates these messages by sound of instruments, the telephone by the human voice usually. Both depend upon electricity for their action. Each is but a form of use—the product and result of the same principle. The different names are used only to distinguish the method of communication. Therefore, the court holds, a telephone company is within the protection and enjoys the privileges of the act of Congress of 1866, authorizing telegraph companies to construct, maintain and operate their lines over and along post roads of the United States, but so as not to interfere with ordinary travel. At the same time, it holds that these privileges must be enjoyed, subject to the lawful exercise of the police power, and, while the municipality can establish such lawful provisions as may regulate the use, the court holds that it must, however, refrain from making regulations which will make the use burdensome and intolerable, and so practically impossible.

The establishment of governmental censorship over private telegrams and press matter is a condition unknown heretofore to the present generation of Americans, but it is safe to say that the measure will be accepted in good part by the people as long as it is considered necessary for the vigorous prosecution of the war against Spain. The United States government has seized the cable office at Key West and has cut the cable to Havana. Of course all government business has precedence in transmission, and press and commercial matter is subjected to a strict censorship. All dispatches are supposed to be sent in the order that they are filed, but dispatches that contain matter that is objected to are laid aside, and corrections that are demanded by the censor are made. They are then refiled as new messages. The amount of business offered at the cable office is so great that the censor has his hands full day and night, and great delay under the present arrangement is unavoidable.

Spain has, of course, long since exercised supervision over all telegrams forwarded and received within her domains, and, as related elsewhere, this censorship enabled her to cut off diplomatic relations with the United States before the ultimatum was delivered by General Woodford at Madrid.

The cutting of the cable at Havana is accepted by many as lending color to the statement that the United States would destroy the Spanish cable and thus cut off Cuba from communication with the rest of the world. It is to be hoped that this course will not be found necessary. The American doctrine of preserving the neutrality of the cable systems of the world is gaining ground rapidly, and if this country now practices cable-cutting it will very materially retard the universal acceptance of such a plan. Another consideration which should not be lost sight of entirely is the fact that the so-called Spanish cable is owned largely by English capitalists and that there is no doubt but that complications will arise in case their interests are injured.

WAR NEWS.

General Telegraphic Communication Restricted.—Now that hostilities have been begun, the newspapers will find it difficult to telegraph prompt and reliable news of the doings of the United States fleet in Cuban waters, as the government will see to it that no information prejudicial to its plan of campaign is transmitted through the regular channels. Official notice was given on April 24th that a censorship had been established by the government of the United State at Key West and that code or cipher messages to and from Cuba were forbidden to the public. As shown on the map recently published in the Western Electrician, Key West is a very important point on the cable line from Florida to Cuba, as the wires are laid in the Gulf of Mexico, from Punta Rassa to Key West, and from Key West across the Florida Strait to Havana. The cable office at Key West is now under supervision of the government. Capt. R. E. Thompson, United States Army, signal-service corps, is in charge. The instructions issued to press correspondents prohibit forecasts of the movements of troops and of the army and forbid improper criticism of officers. Advices of engagements between opposing fleets must go first to the department at Washington. Press matter may follow.

At Washington, largely through the efforts of Assistant Secretary Meiklejohn, the building sheltering the War and Navy Departments is now provided with exceptional telegraphic facilities. The office is provided with a large switchboard, with 25 independent wire connections, being a miniature of the large switchboard in the main office of the Western Union Telegraph company. There is also a complete system of loops whereby the secretary of war and his assistants are enabled to communicate almost directly with all telegraphic places in the world. This is in addition to the direct communication afforded by the government wires connecting the War Department with the White House, the capitol, all the executive departments and the army posts at Fort Myer and Washington Barracks. It is asserted that a special private "war chamber" has been fitted up at the executive mansion for the president's use. This apartment is said to be provided with maps, charts, books and papers, telegraphic and telephonic connections and all paraphernalia that will assist in securing confidential information or aid in consultation. An extra force of trusted operators has been secured by the government to handle the war dispatches. Precautionary measures are being made to secure secrecy. All telegraph operators have been warned that it will be considered treason to make public any of the messages received.

Much has been published in relation to the cutting of telegraphic cables in Cuban waters. It appears to be pretty certain that United States naval officers have cut the direct American cable connecting Key West and Havana, but as to the other West Indian cables the newspaper reports are conflicting. As to the Key West cable, it is stated positively that the cut was made about 10 miles out of Havana, and that the southern end of the cable is now moored to a buoy. The Mangrove was recently converted into an auxiliary cruiser, with a complete cable outfit. This gives the government exclusive use of the cable and cuts off a possible source of communication between Cuba and Spain. It is said that the insurgents are between Havana and the other cable ports. It is said to be intended, as soon as the blockade of the southern ports of Cuba is established, to cut the cables between those points and South America, thus entirely severing telegraphic communication between Cuba and the outside world, except such matter as is sent through the United States censorship.

Orders have been issued by the Navy Department to prevent the newspaper boats from following the fleet, thus doubling the difficulty of obtaining accurate information, as well as greatly delaying it.

The exact intention of the government in relation to the French and British cables in the West Indies is not known, if, indeed, a plan has been formulated. The London Times protests against the intention attributed to the United States to cut a cable belonging to English companies, and expresses the hope that America will not establish so evil a precedent, which might be held by Spain to justify the cutting of any cable landing on American soil. It is not believed, however, that serious complications will grow out of the situation, as the international agreement on the subject of submarine cables only provides for times of peace. It is also pointed out that offenders can only be tried in their own country.

Electricians in the Service.—The Boston correspondent of the Western Electrician writes that many electricians in Massachusetts are volunteering their services to the United States. Representative ?. H. Hoyt of Haverhill has already accepted a position with the government and has been assigned to electrical work in the signal service of the district which extends from Chatham north to the New Hampshire line. This work is under the supervision of Lieut. Sewall, U. S. A. Mr. Hoyt sent in his resignation several weeks ago, to take effect as soon as war was declared, but it was afterward discovered that he could hold his seat in the Legislature although he was in the employment of the United States. City Electrician Edward Hesselton of Haverhill has also tendered his services to the government.

The Navy Department is enlisting qualified men for the ratings of electrician. Applicants must be capable of performing all duties pertaining to the care, preservation and manipulation of a ship's electric-lighting plant and its appurtenances, together with all other electrical appliances; they must also be physically qualified. First enlistment is made in the rating of electrician, second class ($35 per month), with possibility of future advancement to electrician, first class ($40 per month) and chief electrician ($50 per month). In addition to the pay stated, there is a ration allowance of 30 cents per day. Enlistments in this rating are made only at the navy yard, Brooklyn, N. Y.

It is stated that a separate division of the naval reserves is being organized by Frank J. Sprague in New York. It is to consist of about one hundred men, one-half of whom are to be electricians and the remainder telegraph operators and signal-men.

Carl F. R. Hartmann of Newark, N. J., is organizing a signal corps to work with the volunteer forces in war, and has already gathered about a dozen telegraphers, electricians and surveyors. The membership of the corps is to be limited to 40.

Diplomatic Dispatch Tampered With.—The delay of General Woodford in presenting to the government of Spain the cabled ultimatum of President McKinley, which enabled the Spanish cabinet to "save its face" by breaking off diplomatic relations, is explained by the assertion that the message did not reach the American minister at the time it should have done, being withheld by the telegraphic authorities in Madrid and submitted to the Spanish government. It is charged that the dispatch was an open one, in plain English, and that it was received in Madrid at 11 o'clock on Wednesday night, April 20th, and was held by the government until three o'clock Thursday morning. Meantime the Spanish note was prepared, and was delivered to Minister Woodford at seven o'clock in the morning. By means of this duplicity, it is claimed, the Spanish government was able to avert the reception of the ultimatum.

Electrical Work Along the Coast.—The greatest activity in the preparation of the coast defenses for a state of war is still manifest, and of course the installation of electrical apparatus for communication, for the firing of torpedoes or mines, for searchlights or for other purposes, is an important part of the work. New York harbor is now pretty well prepared. General Greely, in charge of the telegraph and telephone communication between seacoast fortifications, has announced that the New York harbor cable to Sandy Hook is completed; also those to Fort Wadsworth and to Fort Schuyler. Work on the signal stations along the south shore of Long Island and on the telegraph and telephone lines to connect the forts and works with New York is progressing toward completion. The signal station at Quogue has been completed, and the one for Southampton is under way. The signal towers are to be manned by the New York naval reserves, and rockets and lights will be used for night signals and block signals for day work. These towers are for the purpose of announcing the approach of hostile vessels toward the coast. A difficulty has been encountered in the waters near New York. Off Fort Wadsworth it has been found that shad fishermen, whose nets have been spread there, have not hesitated to cut the cables of mines and torpedoes already planted. After this discovery the boats from which the engineers were working were armed with the rifles of the men. The Narrows are now patrolled every night, and a strict watch is maintained by day. The first fisherman caught cutting cables will be arrested and the next one may be shot on sight.

A New York paper of Monday says that the powerful searchlights at Sandy Hook were kept going all Saturday night and again Sunday night. The long rays were sent in all directions, and frequently were turned into the Lower Bay and into the Narrows. At times from South Beach every buoy in the channel could be made out, and all craft in the Lower Bay were seen clearly and plainly.

Galveston harbor has been mined. All of the torpedoes have not yet been placed, but enough have been put down to insure the safety of the harbor from hostile vessels. The bar pilots will be given courses to steer clear of the torpedoes, and they will be advised to move vessels through the channel at the slowest possible speed, only going fast enough to give the vessel steerage way. The wires which will be used to fire the mines have been laid and tested. Of the 50 circuits all worked satisfactorily except four.

A coast signal station has been established at Block Island, R. I., opposite Montauk Point. A gentleman of Providence has tendered his summer residence for the station, and the detail consists of a lieutenant and six men from the naval reserve battalion at Newport. The laying of mines and the wiring in the passages to Narragansett Bay have been begun.

The torpedo station at Portland, Me., has recently been equipped with a dynamo, and this is now ready for use. The electric batteries at Portland Head have also been installed, and the mines so far laid are ready for use. Other harbors and the rivers along the Maine coast are to be protected by torpedoes. This work will be done as soon as the government engineers complete the defenses of Portland.

With other cable manufacturers, the Standard Underground Cable company of Pittsburg is very busy on government work. J. W. Marsh, vice-president of the company, says that the cost of these cables will be from $40,000 to $50,000, and even though night and day is being spent in constant work upon them, the contract can scarcely be filled this month, and it will run far into May. The contract calls for single-wire and seven-conductor cables. Most of it is to be used in making connections between the land and the submarine torpedoes and mines that are to be operated by electricity, but there will be some underground cables for the forts.

The work of fortifying the approaches to the harbor at Norfolk, Va., by means of submarine mines is now about complete. The supplying of Fort Monroe with the great 60-inch searchlight which was used at the World's Fair and its equipment with a modern battery of rapid-fire guns for use against torpedo boats and light-draught gunboats have greatly increased the fort's efficiency.

The work of laying cables, anchors and buoys in Hampton Roads and at the mouth of the Chesapeake Bay is rapidly nearing completion, and will in a few days be sufficiently advanced to permit of the submarine mines, now closely guarded in the Fort Monroe arsenal, being attached within 24 hours after the order is issued. The principal keyboard operating this deadly network of mines is located in the "holy of holies" inside Fort Monroe, where no outsider is permitted to go. Another keyboard is also operated from Cape Henry.

Use of the Telephotos.—The War Department has decided to erect sets of the telephotos at the fortifications at Boston, New York, Fort Monroe, Key West and San Francisco, so that news, instructions and general communications can be transmitted by night as well as by day between the army fortifications, which will be in telegraphic communication with Washington, and the fleets or vessels of the navy which may be under the guns of the forts or in adjacent waters. At any moment it may be of the greatest importance to communicate with the vessels of the navy from the shore after nightfall, and with a set of telephotos on a mast or at a fort, instant communication may be had. At the fortifications, where the telephotos are first to be put in, an electric plant, suitable for the working of the signals, is already established. It is also the intention of the government to equip other stations along the coast with these signals, and a plan for a small power plant, suggested by Mr. C. V. Boughton, the inventor of the telephotos, is likely to be adopted. Mr. Boughton advised that a small automatic gasoline engine, connected to an incandescent dynamo of a size sufficient to supply the lights for the telephotos, could be installed at a small cost, and could be run without requiring the services of a skilled engineer or attendant. It is probable that such plants will be installed along the seaboard, where sections of the coast-guard fleet will lie.

A Poor Joke.—This advertisement, which appeared in several of the New York papers, caused more than a little trouble recently:

"Electricians to go to the front at once, under the supervision of an expert; first-class men only as volunteers; construction, incandescent and bell men preferred.—J. W. Sisk, No. 105 Broadway."

From early morning until noon, says the New York Tribune, electricians of all sizes, ages and kinds appeared at No. 105 Broadway, which is the Western Union building, and were referred to the fourth floor of the building. The elevator men carried up and down the largest crowds of the year, and got tired of answering questions. The advertisement was the work of a practical joker. J. W. Sisk is the wire and electric-light man of the building, and someone who knew that he was to be away yesterday caused the advertisement to be inserted.

It would not have been good for the practical joker to have acknowledged in the presence of the applicants the authorship of the joke. Martin Sisk, a brother of the man whose name appears in the advertisement, and who is a lineman, appeared in the crowd and proceeded to make merry, but his jocularity was cut short by the angry and duped applicants, all of whom appeared to be greatly chagrined at having no opportunity of going to the front.

Holland Submarine Boat.—Mr. Holland says that he has had an offer from France for his submarine torpedo boat, but he wants to sell it to his own government. He asks $175,000 for the vessel. Mr. Holland has made the remarkable proposition to go to Key West, join Admiral Sampson's squadron, and with his own crew enter the harbor of Havana by night and throw a dynamite bomb into Morro Castle. Mr. Holland will undertake this if the government will guarantee to purchase the vessel at the conclusion of the performance. The strategy board fully recognized the tremendous moral effect such an assault would have upon the Spaniards, if successful, and was disposed to agree to the terms, but the civilian authorities of the navy have preferred to take the matter under further consideration.

Miscellaneous Notes.—Representative Hull, chairman of the military affairs committee has introduced a bill to increase the efficiency of the

[*Continued on page* [illegible].]

DEVELOPMENT OF THE TELEPHONE FIELD.

Auxiliary Signals as Applied to the Telephone.

By H. P. Clausen.

Ordinarily a telephone station need not be supplied with more than one audible signal receiver; at times, however, it is necessary to meet conditions where an auxiliary signal must be installed. The writer believes that an article descriptive of auxiliary

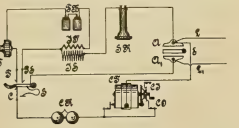


FIG. 1. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

apparatus might prove of considerable interest to the telephone-exchange superintendent and his assistants. It is to be hoped that the reader who desires to make practical use of some of the suggestions offered is sufficiently familiar with telephone apparatus so that a reference or sketch pertaining thereto may be readily understood, even if it does refer in part to apparatus not described in detail, as such descriptions would not be within the

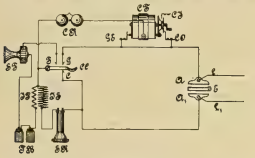


FIG. 2. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

limited scope of an article which in reality is intended to deal with extension bells.

The well-known magneto ringer that sounds a continuous alarm when supplied with an alternating current of the proper character will be considered as forming a part of all telephone instruments that may be referred to. The driving gear of the magneto generator, it will be assumed, is arranged with

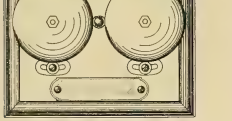


FIG 3 AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE

the necessary provisions for automatically shunting its armature winding out of circuit, and also for connecting its winding to another circuit whenever the machine is operated with the intention of transmitting a call.

Two methods are shown for interconnecting the parts of a telephone station. Fig. 1 represents the most common type. It is employed almost exclu-

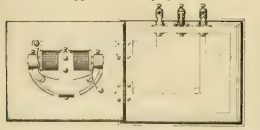


FIG. 4. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

sively by builders of telephone instruments for use by the independent companies, and for the sake of distinction we will name it the "cut-out method," which term in fact is quite appropriate, for when the telephone hook C C is allowed to move upward, its contact with C is broken, thus cutting out the magneto bell C R and the magneto generator C T. A downward movement cuts out the transmitting and receiving apparatus. In Fig. 4, however, a method is shown where the desired combination of circuits is produced by a "shunting method." Most any make of telephone may be equipped with this method of wiring, which is shown quite clearly in the cut. One fact, though self-evident, should be mentioned in connection with a reference to the "shunting method," namely, that if either by design or accident both the C and G springs be broken, or entirely removed from contact with the hook switch C C, the calling or talking circuit is not destroyed, for the calling circuit finds an easy path through the telephone receiver and the secondary winding of the induction coil, whereas the talking circuit is continuous through the magneto ringer and over the shunt wire of the generator. An amusing case came to the writer's notice where the engineer of a telephone company returned to the maker a telephone instrument wired on the shunting plan, and explained that the instrument had been rejected because "there certainly must be something radically wrong with an instrument that would ring or talk with but one hook spring in place." When it is considered that the engineer experienced at the time

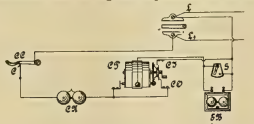


FIG. 7 AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

a great deal of trouble from poor hook contacts the remark can better be appreciated.

Fig. 3 shows an outside and Fig. 4 an inside view of the magneto-extension bell. The type of instrument is well known, and requires no further description. In Fig. 5 an extension bell is shown connected in series with the line wire L'. The switch S is connected across the extension-bell terminals, and when the switch lever is moved to the right it short-circuits the bell terminals. The extension bell employed should be wound to a very low resistance, and even then it offers an unnecessary resistance to

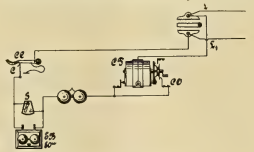


FIG. 6. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

the passage of the telephonic currents. However, with the same type of bell and switch placed in the telephone circuit as indicated by Fig. 6, it is cut out of circuit whenever the hook switch CC is allowed to produce a talking circuit. As a general rule, the extension bell is placed in a different room than that containing the telephone instrument; therefore, when anyone desires to call the central office he must, before calling, cut out the extension bell, for if this were not done it would cause the sounding of a false signal in the room where the extension bell may be located. Furthermore, even if the switch

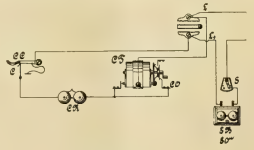


FIG. 5. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

is cut off when calling the central office, the user when he had finished might neglect to restore the switch to a position allowing the extension bell again to form a part of the calling circuit. For the purpose of avoiding this at times very serious objection to the use of an extension bell, the method shown in Fig. 7 may be employed with good results. Normally the extension bell forms a part of the calling circuit with a branch wire connecting to the normally open "cut-in" spring C I. The switch S may be employed, but it is not required to be operated, as explained in Figs. 5 and 6, for when the magneto generator is operated with the purpose of originating a call, the shunting arrangement with which the crank-shaft is provided makes contact with the "cut-in" spring C I, thus automatically short-circuiting the extension bell. The method is thoroughly practical, and can be applied to most instruments employing a generator shunt operated by a direct movement in some part of the armature driving gear.

Quite often ordinary exchange telephones are placed two or more in series, that is, looped in on one circuit, but this plan is not to be recommended. Suppose we have a circuit containing five telephones, and that it is necessary to place an extension bell at each station. As it is, the five-bell coils already in the circuit prove an objectionable barrier

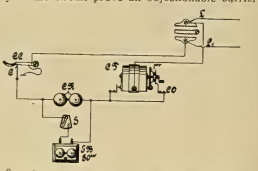


FIG. 8. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

to the telephonic currents, and the addition of five extension bells might destroy all attempts at giving a satisfactory service. Such would indeed be the fact were it not for the plan suggested by Fig. 8, that is, of connecting the extension bells in multiple with the bell coils of the telephone, the switch S cutting the extension bell in and out of circuit as desired. When all extension bells are in circuit, however, the talking service has been improved merely because

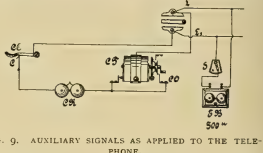


FIG. 9. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

the resistance offered by every telephone instrument has been halved by the addition of another bell connected in parallel with itself; in other words, if each bell measures 80 ohms, and with 50 ohms line resistance, a series of five bells would give us 450 ohms. Now if we add the extension bells, each 80 ohms, we have reduced the resistance to 250 ohms, whereas if the bells had all been connected in series a resistance of 850 ohms would have been produced, which is quite enough to bar ordinary voice currents.

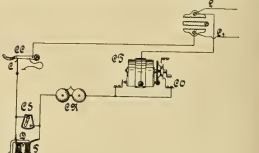


FIG. 10. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

Specially high-wound extension bells may be employed quite freely, and connected to any point of the telephone line. One rule, and it is a good one, is never to cut a wire or open a circuit when connecting a high-wound extension bell to a telephone line. Fig. 9 indicates the common method of connecting the high-wound bell. The switch S must allow an opening and closing of the bell circuit to one of the line wires. The term high-wound, if

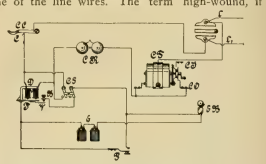


FIG. 11. AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

used when speaking of magneto ringers, may imply any resistance of more than 500 ohms, governed, however, by the conditions to be met.

In the preceding section reference has been made wholly to the auxiliary signals whose operation depended on the current generated at some distant station. Though it undoubtedly is the most economical plant, it is not always sufficiently flexible for allowing special requirements to be met. The ar-

rangement shown by Fig. 10 is in reality a simple annunciator drop, such as might be found in most any central-office switchboard, and an incoming call is registered by the falling of a disk. Fig. 11 illustrates the same arrangement with the addition of a local battery and an electric bell, whose continuity is normally broken at the contact points N and B. An incoming calling current, passing through the winding of the magnet D, causes the latter to attract the armature T, which allows the shutter S to fall and force the spring N into contact with the point B, thereby completing the local circuit and causing the electric bell A to sound a continuous alarm, until either the shutter S is restored to its normal position, or the switch C S is thrown to the extreme left side. The push-button P, connected as indicated, is quite a convenience when it is desired to call one of several persons within hearing distance of the bell A, a prearranged code of signals being employed to call the one whose presence may be required at the telephone. However, for the purpose of meeting the demand for an instrument that will give a code signal as it is sent through the telephone by the central-office operator, an instrument has been arranged as shown by Fig. 12.

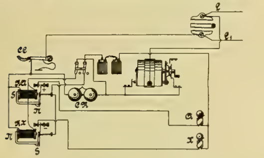


Fig. 13.

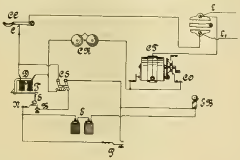


Fig. 12.

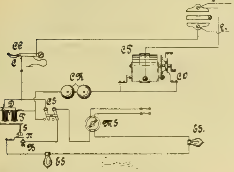


Fig. 14.

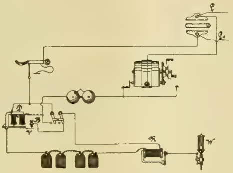


Fig. 15.

AUXILIARY SIGNALS AS APPLIED TO THE TELEPHONE.

In response to an electric current flowing through the magnet D, the armature T, equipped with the spring V, is drawn upward with a slight vibratory motion, making a contact with point B, and thus closing the local circuit only so long as the switchboard operator desires to extend the signal. On first thought it may appear to be an easy matter to construct a relay that will successfully close a local bell circuit in response to an alternating current such as is produced by the magneto generator employed in operating telephone apparatus. It can be done by a very simple trick; in fact, an instrument constructed similar to the one shown in Fig. 12 will answer the purpose under the most difficult conditions; however, to the doubting ones—"seeing is believing."

With a direct-current generator located at the central office, a telephone station may be equipped with an arrangement for allowing the exclusive selection of one of three distinctly separate signal-receiving instruments; that is, an alternating current operates the magnet bell C R (see Fig. 13), a direct current, flowing from the line to the hook-switch C C, operates the relay R A, and a direct current flowing in the opposite direction operates the relay R X; any one of the relays when operated closing its respective local-bell circuit. With properly adjusted armatures and contact points, the arrangement as described gives a very satisfactory service.

Fig. 14 indicates a method of substituting an incandescent lamp for the electric bell shown in Fig. 11. A tap from the lighting mains takes the place of a local battery. The method, though it gives a fairly satisfactory service, is not to be recommended, mainly on account of the danger from fire that an imperfect contact at T B might produce.

Fig. 15 represents an electro-magnet substituted for the electric bell shown in Fig. 12; the armature of the electro-magnet, being permanently connected to the valve of a steam whistle, enables an operator at the central office to produce a call signal that usually results in an immediate response. The device is capable of rendering a very effectual signal; for obvious reasons, however, the plan should be adopted only as a last resort.

Some years ago licensees of the Bell company were put to considerable bother in removing from the subscribers' telephones a little attachment sold and put up by traveling agents. The device consisted of a movable disk arranged with trip, its upper end-prong engaging the rod bearing the tapper of the magneto bell. When properly adjusted and kept so the device served admirably, but soon it was discovered that the addition of a small contact pin would allow the closing of a local bell circuit whenever the disk fell. Naturally, the transmitter battery was pressed into service, with the usual disastrous results, which, of course, led to a speedy removal of all such attachments.

Realizing that many novel arrangements have been designed and are giving successful service as extension signals, the writer would suggest that it might be of interest to know just how much ingenuity has been expended in supplying the actual, and at times, perhaps, the imaginary, needs of our friend the telephone subscriber.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The offices of the Iowa Telephone company have been consolidated at Davenport. There was talk of removing all of them to Des Moines, to be nearer the central part of the state, but after a trial of part of the offices in Des Moines, it has been decided to remove them all back to Davenport.

Work will be begun soon on the line of the Humeston Telephone company at Humeston, Ia.

The Woodbine Telephone company expects to have a line to Mapleton, Ia., from Onawa, Ia., in 60 to 90 days. Connections may also be made with Ute.

Rev. H. E. Walker of West Concord, Minn., contemplates establishing a telephone exchange in Hankinson, N. D. He has gone to look over the field.

Arrangements have been made to extend a telephone line to Rodney, Ia., connecting Oto and Smithland. Rodney people want the line extended to Onawa.

A. B. Tallman, president of the Crookston, Minn., Telephone company, has disposed of his interest to residents of Crookston.

F. G. Barrows has been granted a franchise for a telephone exchange for Fergus Falls, Minn.

C. J. Smallwood has been granted permission by the council of Worthington, Minn., to establish a telephone exchange.

The 100-wire cable of the Oshkosh Northwestern Telephone company at Oshkosh, Wis., crossing the Fox River, was broken, cutting off the south side of the exchange. It is supposed the break was made by the Citizens' Traction company in sinking a feed cable. The company will put in a new cable at once.

Arrangements are being made by the Ottumwa Telephone company and the Moravia Telephone company to connect, by building to Blakesburg. This would give a big improvement to the Centerville connections.

The New Ulm, Minn., Telephone company is arranging to extend its lines to Redwood Falls, Minn., from Sleepy Eye through Evan, Morgan and Gilfillan.

The American Telephone and Telegraph company will connect with New Richmond, Wis.

The Janesville Telephone company has been incorporated at Janesville, Wis., with $25,000 capital stock.

The Hyde and Orton Telephone company of Princeton, Mo., contemplates establishing a telephone exchange in Centerville, Ia.

The Chamber of Commerce in St. Paul has passed resolutions urging the council to grant a franchise for long-distance telephone service.

A farmers' telephone line has been built from Harmony, Minn., to Kendallville, Ia., and proposed to go to Cresco. The mayor of that town demands a tribute before he will allow the company inside the corporation. He raises the legal point that the company is not incorporated.

Northwood, Ia., people complain of the service they receive from the Iowa Telephone company.

Gregg & Dixon and the Central Telephone company of Rockwell City, Ia., will consolidate their exchanges and put in additional capital.

Otis Staples, James Mulvey and R. H. Bronson have been granted a franchise at Stillwater, Minn., for a telephone exchange.

J. J. Greaves has ordered a 50-drop switchboard for a local exchange at Glencoe, Minn.

The local telephone company of New Richland, Minn., will secure long-distance connections over the wires of the Western Electric Telephone company.

The Mississippi Valley Telephone company has deposited $5,000 in St. Paul as a guarantee that it will accept the franchise recently granted. The ordinance also provided for a bond for $25,000 within 30 days of its passage.

The Minnesota Central Telephone company will begin stringing its wires into Minneapolis soon, as far as the conduit limit. The Mississippi Valley Telephone company will have to lay conduits in all the downtown streets before it can install an exchange. It is probable the Minnesota company will use the Mississippi Valley company's conduits.

The Marquette County Telephone company will soon begin extending its system from Ishpeming, Mich., to Humboldt, Republic, Champion and Michigamme.

H. H. Heath of Neillsville, Wis., will establish a telephone exchange in Greenwood, Wis., as part of his system, connecting Marshfield, Neillsville and Merillan.

The Perry Telephone company is building a line from Guthrie Center, Ia., to Panora, and expects to build to Audubon. The Iowa Telephone company first came to Guthrie Center and secured subscribers for an exchange, but did nothing until the Perry company secured a franchise. Since then the proposition of the Iowa company for a franchise has been rejected by vote of the people.

D. A. Kusel.

The portrait presented herewith is an excellent likeness of D. A. Kusel, proprietor of the D. A. Kusel Telephone and Electric Manufacturing company of St. Louis, Mo., an experienced electrician well known in the West. He has been engaged in the electrical manufacturing business in St. Louis and Chicago for the last 30 years. He has been a resident of St. Louis for 20 years and established his present business in 1886 for the manufacture of general electric goods, but since the expiration of the Bell patents in 1893 he has devoted his whole

D. A. KUSEL.

attention to the manufacture of telephones and telephone switchboards. He is the patentee of the D. A. Kusel transmitter, which has gained a wide and favorable reputation over a large portion of the country. His wide and thorough experience in this line enables him to superintend his factory with great advantage to the patrons of the company.

Extension of Independent System in Wisconsin.

The Little Wolf River Telephone company has closed a contract with the Oshkosh Northwestern Telephone company, whereby the local exchange is to be connected with the toll system of the Wolf River Telephone company, already in operation in parts of Winnebago and Waupaca counties. The contract calls for connecting the two systems by June 1st. The line, as projected from Fremont, where it ends at present, will run through Dale, Winchester, Larson, Allenville, Butte des Morts, Winneconne, Omro and thence to Oshkosh. A great many of these towns have at present no telephone system, and much of the trade from these points comes to Oshkosh.

At present the Wisconsin Telephone company charges a rate of 25 cents for Oshkosh residents who desire to talk with towns in Waupaca County, and to points in Winnebago County 20 cents. The toll rate of the Northwestern exchange will be to

cents to points in Winnebago County and 15 cents to Waupaca County points.

Immediately after the extension from Fremont to Oshkosh is completed, another extension from Larson to Neenah, Menasha and Appleton is to be made, followed by another from Symco, in Waupaca County, to Antigo, running through Bear Creek, Clintonville, Embarrass, Hunting, Marion, Split Rock, Tigerton, Whitcomb, Wittenberg, Eland Junction, Mattoon, Elmhurst. No telephone lines at present touch these points, and Oshkosh patrons of the Northwestern company will be enabled to talk direct with these points for a nominal sum. The line is already built from Symco through Manawa, Little Wolf, Royalton, Northport, New London, Weyauwega, Waupaca, Fremont, Orihula, Alder Creek and Tusten.

Independent Long-distance System for Indiana.

The movement for an independent long-distance telephone system in Indiana, with headquarters at Indianapolis, has resulted in the formation of the New Long-distance Telephone company, with a million dollars capital, by A. H. Nordyke of Indianapolis; Daniel E. Doherty of Louisville, Ky.; Alexander F. Ramsey of Crawfordsville, Ind.; George W. Beers of Fort Wayne, Ind.; Harry B. Gates, Simon P. Sheerin and David M. Parry of Indianapolis. The incorporation fee was $1,002, the largest that Secretary of State Owen has received for some time. It is understood that the gentlemen named are to be the directors of the organization, and that Mr. Sheerin is to be the president, Mr. Ramsey the vice-president, Mr. Nordyke the treasurer and that the secretary has not yet been elected.

Concerning the new corporation, Mr. Sheerin is reported to have said: "This organization has been in contemplation for some time, and may be said to be already perfect in all its parts. It has been the intention of the gentlemen composing the New Telephone company to build sufficient long-distance lines to connect with Indianapolis all the independent long-distance lines now operating in the state and such other lines as may hereafter be constructed. We were not at first clear as to whether we would form a separate organization and increase the capital stock of the Indianapolis company to an extent sufficient to embrace the other work. The action of the Board of Works, however, in limiting the capitalization of any company bidding upon the franchise in this city settled that question for us, and we then determined upon the separate organization. All of the gentlemen interested in the New Telephone company are interested in the one just incorporated.

"We will begin at once and will have the long-distance lines in operation long before the work in this city can be completed. A good deal of long-distance business can be done by special-messenger service in the city until such time as the exchange is ready for operation."

The Indianapolis Sentinel says that it is understood that Mr. Beers, who is a practical electrician and experienced telephone man, is to superintend the construction of the long distance lines. Mr Beers is the president of the Home Telephone company of Fort Wayne and also of the National Long-distance Telephone company, which operates about 1,000 miles of long distance lines in the northern and eastern part of the state.

Mr Ramsey is president of a long distance telephone line in the western part of the state, with headquarters at Crawfordsville, which controls about 600 miles of long distance lines.

The Sentinel also announces that several other gentlemen interested in long distance telephone business in different parts of the state have become member of this long-distance telephone company.

Southern Iowa Telephone Service.

Charles McFatridge, manager of the Moravia, Ia., Telephone company, proposes to extend the Moravia system to Blakesburg, providing that Manager Martin of the Ottumwa company will build a line to that city. In this event Manager McFatridge promises to extend the Moravia line to Confidence, and through such a combination Centerville would secure telephone connections with the following towns in southern Iowa and northern Missouri touched by the consolidated companies: Mystic, Seymour, Promise City, Confidence, Allerton, Warsaw, Lineville, Davis City, Kellerton, Ellston, Mount Ayr, Caledonia, Clearfield, Lewisburg, Humeston, Groveland, Bethlehem, Des Moines, Brazil, Numa, Mardensville, Bridgeport, Ovid, Harvard, Clinton Center, Spring Valley, Lamoni, Lesan, Tingley, Maloy, Ringgold, Conway, Smiths, Weldon, Osceola, Indianola, Lorimer, Jerome.

THE "LITTLE HUSTLER" FAN MOTOR.

Genoa, New York, Corydon, Cambria, Sewall, Clio, Pleasanton, Tuskega, Beaconsfield, Benton, Wanamaker, Leon, High Point, Garden Grove, Leslie, Ravenna, Mo., Andoar, Princeton, Bethany, Powersville, Burlington, Marysville, Unionville, Albany, Cainesville, Modena, Mercer and Ader.

The scheme has received the endorsment of the principal telephone men of the towns named and has enlisted the enthusiastic support of the merchants of these places.

Independent Telephony in Southwest Missouri.

Three years ago the first indepdent telephone line was built from Humansville to Hermitage, a distance of 25 miles. This was the beginnng of the system, which to-day comprises over 400 miles of toll lines, with 71 toll stations, nine of which are county seats—Sedalia, Clinton, Warsaw, Osceola, Hermitage, Buffalo, Bolivar, Stockton and Greenfield.

CARD GENERATOR.

Four companies support the system, including the Hull Telephone company, with headquarters at Humansville, the St. Clair County Telephone company, whose main office is at Appleton City, the Russel Telephone company of Brownington and the Taylor Telephone company at Greenfield.

The Taylor company is now building to Mount Vernon, and will there intersect the Armstrong lines, which will add over 200 miles to the independent telephone systems of Southwest Missouri. Most of the stations reached in this system have a population of less than 4,000, and the Bell people have been slow in providing service for them.

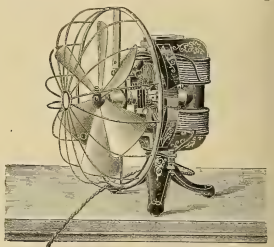
Most of the leading citizens in this territory are interested in the home companies.

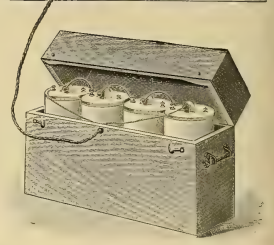
The "Little Hustler" Fan Motor.

As the cut shows, this is a small fan motor, battery driven. It is sold at a remarkably low price, and yet is said not to be a toy but a correctly designed motor for commercial use. It can be used in connection with any suitable type of battery. This motor is made by the Knapp Electric and Novelty company of 47 Warren street, New York.

Card Generator.

The 225-kilowatt generator illustrated herewith is the latest design brought out by the Card Electric company of Mansfield, Ohio. Every part of the machine, while massive, is well proportioned and made to withstand hard work and rough usage. The armature has some special features in the way of conveniences for ready inspection and repairs which will be appreciated by purchasers. With the winding on this armature it is possible, by unsoldering not to exceed 12 connections at the commutator, to remove any coil from it without disturbing





NEW EDISON FAN MOTOR.

any other coil in the body of the armature. This the company will guarantee. The provisions for uncovering the armature are both simple and effective. By means of the screw and lever on the base-frame the two supporting bearings and armature are forced rearward or the base until the armature body is in the place of the pulley and the commutator completely uncovered; in this position any of the field coils can be removed. A reverse movement of the screw returns all of the parts to their proper place. With heavy windings, a large commutator and improved brush-holders, this generator is well fitted for any kind of heavy duty, and the company reports a large number of recent sales, which keeps it busy night and day.

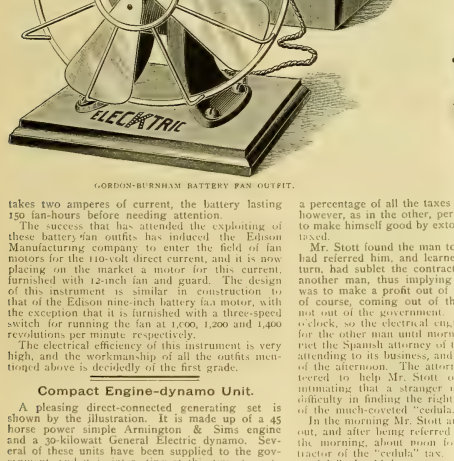
New Edison Fan Motor.

Several new battery fan-motor outfits are being placed on the market by the Edison Manufacturing company of New York and Orange, N. J. The Edison nine-inch battery fan outfit is shown in the cut. This outfit is furnished with a motor having a Paccinoti ring armature, carrying a nine-inch fan and guard, and operated by four Edison-Lalande cells, type "S" (300 ampere-hour capacity), in polished oak box, together with battery cord. The motor is now provided with ball bearings, and the results that have been obtained by this innovation are so remarkable as to call for a detailed description.

When this outfit was first placed on the market, four or five years ago, the motor was of the six-pole armature type, and ran for about 100 fan-hours, at a speed of 700 revolutions per minute, before the battery needed to be recharged. In the spring of 1897 this motor was entirely redesigned, being replaced by one having a Paccinoti ring armature. The immediate results were very gratifying to the manufacturers, as the working current was de-

creased so that the battery would now run the fan for 125 fan-hours before needing renewal, and the speed of the motor was increased to 800 revolutions per minute. In order to further increase the efficiency of this motor, the use of ball bearings was finally decided on, after a most exhaustive test extending over several months; and the results that are now obtained fully justify the innovation which has been made. The frictional loss has been so greatly diminished by this means that the new ball-bearing motor (1898 model) only takes 1.75 amperes when running the fan, and as the battery has a capacity of 300 ampere-hours, it follows that the motor will run 170 fan-hours before the battery is exhausted. The speed of the fan is also increased to 850 revolutions per minute. It is interesting to compare the successive steps which have been made in the perfecting of this motor. Considered from a battery point of view only, the new ball-bearing motor is 33½ per cent. more efficient than the 1897 model and 70 per cent. more efficient than the original type. Furthermore, the speed of the fan is increased from 700 revolutions per minute to 850 revolutions per minute, which is even more important than the economy that has been effected in the battery.

The Edison iron-clad battery-fan outfit, manufactured by the same concern, has also been considerably improved this season. It consists of an iron-clad motor, carrying a seven-inch fan and guard, and operated by three Edison-Lalande cells, type "S," in polished oak box. The improvement consists in the substitution of a small drum commutator for the flat-disk commutator, which was formerly used on these motors, and the extension of the rear shaft support (carrying the brushes) beyond the iron-clad field, thereby enabling the brushes to be easily and quickly adjusted. This motor runs at a speed of 1,200 revolutions per minute, and



GORDON-BURNHAM BATTERY FAN OUTFIT.

takes two amperes of current, the battery lasting 150 fan-hours before needing attention.

The success that has attended the exploiting of these battery fan outfits has induced the Edison Manufacturing company to enter the field of fan motors for the 110-volt direct current, and it is now placing on the market a motor for this current, furnished with 12-inch fan and guard. The design of this instrument is similar in construction to that of the Edison nine-inch battery fan motor, with the exception that it is furnished with a three-speed switch for running the fan at 1,000, 1,200 and 1,400 revolutions per minute respectively.

The electrical efficiency of this instrument is very high, and the workmanship of all the outfits mentioned above is decidedly of the first grade.

Compact Engine-dynamo Unit.

A pleasing direct-connected generating set is shown by the illustration. It is made up of a 45 horse power simple Armington & Sims engine and a 30-kilowatt General Electric dynamo. Several of these units have been supplied to the government, and it is interesting at this time to note that two furnish current for the United States forts at Castle Island, Boston Harbor. The engine has cylinder dimensions of 9½ by 10 inches, and operates at about 300 revolutions per minute. It is equipped with the Rites inertia governor, self-adjusting piston valve and special oiling devices.

Gordon-Burnham Battery Fan Outfit.

The Gordon-Burnham Battery company of New York has received so many urgent requests asking for a combination which should include its Gordon primary cell and a fan motor that it has decided to furnish the outfit desired, and accordingly has made arrangements to provide the Knapp battery motor, which has been long in use before the electrical trade, using the 1898 models and recommending types C and D, which have ball bearings and are very efficient. The Gordon-Burnham company will also exclusively handle the Knapp motor B2, C2 and D4. The long life of the Gordon primary cell is known in the electrical trade, and the company's guarantee to operate at a good discharge rate for six months without any attention gives to the electrical trade a battery well fitted for fan-motor work. The economy of maintenance of the Gordon cell is also a great advantage.

Spanish Business Methods.

H. G. Stott, superintendent of the Buffalo General Electric company, tells a story of his experience in Madrid. Some few years ago, before he came to America, he was employed by an English company, which had a contract to establish an electric-lighting plant in Madrid, and he was sent there as the representative of the company. Before he went he was informed that all foreigners, before they attempted to do business in Spain, were obliged to take out a government license, nominal in amount, called the "cedula." It was early afternoon that he arrived in Madrid, and as soon as he had settled himself at the hotel, he started out to find the government office where he was to take out his "cedula." He found the office, but, on applying for his permit, he was told that the government had "farmed out" the cedula tax to a certain individual, and that it would be necessary to look this individual up.

Now in Spain the farming out of a tax means one of two things; either that the government sells the collecting of the tax to some individual for a sum as great as the government expects to secure from the tax for the year, the government tacitly admitting the individual's right to make his speculation good by raising the amount of the tax on the persons taxed, or in some cases, the government sells the collecting of the tax for a fixed sum and a percentage of all the taxes collected; in this case, however, as in the other, permitting the tax farmer to make himself good by extortion from the persons taxed.

Mr. Stott found the man to whom the government had referred him, and learned that this person, in turn, had sublet the contract for the collection to another man, thus implying that some one else was to make a profit out of the tax, all this profit, of course, coming out of the persons taxed, and not out of the government. It was now about six o'clock, so the electrical engineer gave up looking for the other man until morning. That evening he met the Spanish attorney of the company, who was attending to its business, and related his experience of the afternoon. The attorney smiled and volunteered to help Mr. Stott on the following day, intimating that a stranger might still have some difficulty in finding the right man for the issuance of the much-coveted "cedula."

In the morning Mr. Stott and the attorney started out, and after being referred from man to man all the morning, about noon found the last sub-contractor of the "cedula" farm. Good to law the "cedula" should have cost about two pesetas, or 40 cents. When Mr. Stott started to pay he was amazed to have the tax farmer calmly demand 20 pesetas, or about $4. This extortion aroused the ire of the attorney, and he went for the tax farmer. After an oration of half an hour, five pesetas were thrown off, making the price about $3. This encouraged the attorney and he started in again, the result being that three more pesetas were dropped, making the tax about $2.40, which Mr. Stott paid, feeling his company could better afford paying this amount of tax instead of the ball the attorney was likely to present. The result justified his foresight.

"The Spaniards have no real idea of public honesty," said Mr. Stott. "Poverty is the general condition of the laboring classes; poverty of a kind this country knows little about, and yet no one hesitates to take advantage of the most miserable of these creatures. We could not prevent foremen of the construction gangs from robbing the workmen under them. They would bleed them of a portion of their miserable wages, and no matter what we paid, the foreman got the greater part of it.

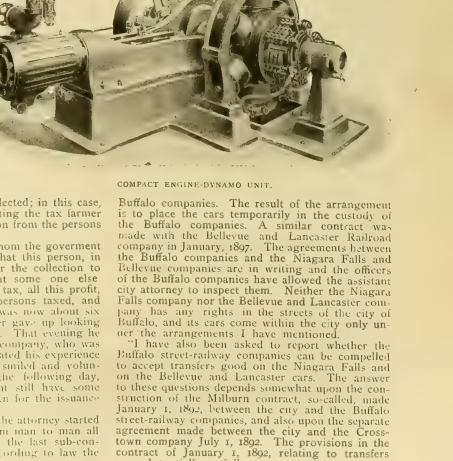
"We could not employ Spaniards to read meters, after the company began to supply light, for they would invariably go to the consumer and make an arrangement to turn in a short reading for a given consideration. A Spaniard of high respectability told me that he never thought of paying what his gas bills properly came to. He gave the meter-reader four or five pesetas a month and the fellow cut the reading down enough to save him three or four times the amount. Our contract was to put in the electric-lighting plant and run it six months, which we did. At the end of that time the Spanish company which was to manage it offered me double the salary I was getting from the English company and a three years' contract, if I would stay and manage the plant. But I was utterly disgusted with the Spaniards. I had had enough."

Street-railway Companies' Rules and Regulations.

An opinion of interest to trunk-line trolley companies was recently given by Corporation Counsel Cuddeback of Buffalo on the question of whether the Niagara Falls and Lancaster roads should be compelled to accept transfers on their lines, and also as to the rights of these companies to operate their cars within the city limits. The opinion is as follows:

"I have been directed by your honorable body to ascertain and report what rights the Niagara Falls railroad cars and the Bellevue and Lancaster cars have in the streets of the city of Buffalo.

"I find that in November, 1893, an agreement was made between the Buffalo street-railway companies and the Niagara Falls company, which was modified in May, 1897; and that by the provisions of the agreement, as modified, the Buffalo companies take the cars of the Niagara Falls company at the city line and run them over the tracks in the city and return them to the Niagara Falls company at the city line. While within the city the cars and the crews thereon are entirely within the control of the



COMPACT ENGINE-DYNAMO UNIT.

Buffalo companies. The result of the arrangement is to place the cars temporarily in the custody of the Buffalo companies. A similar contract was made with the Bellevue and Lancaster Railroad company in January, 1897. The agreements between the Buffalo companies and the Niagara Falls and Bellevue companies are in writing and the officers of the Buffalo companies have allowed the assistant city attorney to inspect them. Neither the Niagara Falls company nor the Bellevue and Lancaster company has any rights in the streets of the city of Buffalo, and its cars come within the city only under the arrangements I have mentioned.

"I have also been asked to report whether the Buffalo street-railway companies can be compelled to accept transfers good on the Niagara Falls and on the Bellevue and Lancaster cars. The answer to these questions depends somewhat upon the construction of the Milburn contract, so-called, made January 1, 1892, between the city and the Buffalo street-railway companies, and also upon the separate agreement made between the city and the Crosstown company July 1, 1892. The provisions in the contract of January 1, 1892, relating to transfers are substantially as follows:

"The companies agreed to abolish all transfer charges after January 7, 1892, and thereafter to charge a uniform fare of five cents for a continuous trip by the most direct route from any point on any of the street railroads owned and operated by said companies to any other point thereon, to the end that there should be a uniform five-cent fare for a continuous trip to any point by the most direct route over any portion of the railroad system operated by the companies.

"By the agreement of the Crosstown company the provisions of the Milburn contract are applied to that part of the street railway running on Broadway between Bailey avenue and the city line. The Crosstown company by its agreement is also made subject to section 101 of chapter 565 of the laws of 1895, which prohibits the company from charging any passenger more than five cents for one continuous ride from any point on its road or any road,

line or branch operated by it or under its control, to any other point thereon, or any connecting branch thereof.

"There is no doubt that under these contracts and under the statute referred to, the street-railway companies have the right to adopt reasonable rules and regulations to facilitate their business and prevent imposition in the matter of transferring passengers from one line to another.

"I understand that the street-railroad companies refuse to give transfers to the Bellevue and Lancaster cars and refuse to accept Niagara street transfers on the Niagara Falls cars. The attorneys for the street-railroad companies inform me that these cars are intended primarily for through traffic, that is, for passengers who wish to go to Niagara Falls or to Lancaster or to points beyond the city line. The only question is whether it is a reasonable regulation to refuse to give or accept transfers upon these through cars. It seems to me that it is a reasonable regulation and quite as much to the advantage of the public as of the railroad company, provided always that the railroad companies furnish other and sufficient accommodations for local passengers. So far as street railways are concerned I think there are not many decisions upon the question by the court, but the same question has frequently arisen in regard to steam railroads, and the right to make and enforce reasonable regulations has been upheld. The street-railroad companies must, of course, comply with their contracts and with the statute, as reasonably interpreted. Their obligation is to charge only five cents for a continuous trip by the most direct route from any point on any of the street railroads owned and operated by them to any other point thereon. If they furnish a sufficient number of cars so that there is no vexatious delay in transferring passengers, may not also run through cars, and, to prevent overcrowding, restrict the use of them to through passengers? It would seem that they may, for the same reason that steam-railroad companies are allowed to run through trains and fast express trains which do not stop either to take on or let off passengers at way stations. If the street-railroad companies are held to their obligations to run sufficient cars to accommodate traffic within the city, the necessity of the public will be satisfied and no harm will come if the companies are allowed to operate what have been called through cars over their lines.

"It should always be understood when I say a rule or regulation of a street-railroad company is reasonable that I am simply exercising my judgment as to what the courts would probably hold in regard to such rule or regulation, and that the expression of my own opinion goes no farther than that.

"There is another question that I might as well answer in this communication. A petition by the residents on Tonawanda and other streets at Black Rock, asking that the street-railroad companies be compelled to run cars on Hertel avenue and Tonawanda street to the city line all night, and to use large vestibuled cars upon that portion of the line, has been referred to me.

"The grant from the city to the Crosstown Railroad company to operate the line in Tonawanda street gives the council full power in the matter, but, of course, the power must be exercised reasonably. I do not know enough about the situation to say whether the prayer of the petition should be granted, but if it is necessary for the accommodation of the public that cars should run all night on the city line on Tonawanda street, and that better cars should be used, then the street-railroad company should be compelled to comply with the petition."

WAR NEWS.

[*Continued from page 255.*]

United States Army in time of war by organizing field-telegraph corps.

A correspondent at Matanzas sends word that the steamship Vigilancia was driven from the harbor on Thursday night (April 21st) in order that the harbor might be mined. It is in such condition now that it would be perilous for any vessel to enter the harbor, and the Spanish authorities have made arrangements to notify any ship that sought to enter, save those belonging to the United States.

They have curious dynamos in Havana, if the correspondents are to be believed. It is said recently an electric-light dynamo exploded in the navy yard there, blowing off the head of an employe and seriously wounding the foreman of the shop and 10 workingmen.

Chicago street-car men are to be given an opportunity to go to the front. General Manager John M. Roach of the North Chicago and West Chicago Street Railroad companies has ordered a notice posted to state that enlisted men or those who volunteered for war service would be granted leave of absence and that their positions would be held for them when they returned. Superintendent Nagle of the Chicago City Railway company said that the employes of that company would fare similarly.

The New York Herald claims to have established a pictorial telegraph department to its already well-equipped newspaper plant. It recently sent the necessary transmitting apparatus to Key West, Fla., and since its arrival there the Herald has been presenting daily to its readers pictures said to have been transmitted by telegraph. The distance to be traveled by these pictures is about 1,500 miles, of which 160 miles is submarine cable. The time of transmission of a half-page drawing is stated to be 40 minutes.

When the regulars moved south from Fort Sheridan, near Chicago the signal corps took 10 miles of wire, 500 line supports and three wagons loaded with batteries and instruments as its equipment. The rough hills of Cuba are expected to prove formidable obstacles to the work of the signal corps, but its members declare that they can overcome even mountains and swollen rivers in their work.

The Eastern Extension Telegraph company announces that, with a view to improving telegraphic communication with the Phillipines by making such communication independent of the long land line between Cape Bolinao and Manila, it has extended the cable from Hongkong to Manila direct.

A Paris letter of April 23d says that a considerable number of electrical engineers engaged by the Spanish government left Paris on the day before for Ferrol.

National Electric Light Convention, Chicago, June 7th, 8th and 9th.

The most popular line from Cincinnati, Louisville and all points South to Chicago is the Big Four Route via Indianapolis; magnificent sleeping cars and unequaled dining-car service. For maps, rates, etc., address E. O. McCormick, passenger traffic manager, Big Four Route, Cincinnati, O.

CORRESPONDENCE.

New York Notes.

New York, April 25.—As the time draws near for the electrical exhibition the interest is increasing, even amid the war excitement. A lately arranged feature is a series of eight illustrative and historical wax tableaux, designed to mark some of the successive stages of electrical development, prepared by Dr. Park Benjamin, Prof. F. B. Crocker and Mr. F. C. Martin, and executed and arranged by the Eden Musee company. The series will include the "First Recognition of an Electric Effect," when the Syrian woman, many centuries ago, wonderingly perceived light objects flying to her amber spindle; the "Mariner's Compass," ascribed to the Chinese and Italians, but probably to be credited to the Finns, in the eleventh century; "The Earth a Great Magnet," William Gilbert explaining the terella to Queen Elizabeth, 1600; the "First Conductors or Circuits," Stephen Gray, a Charter House pensioner in London (1720), experimenting on the conduction of electricity; the "Leyden Jar," showing the "botting" of electricity and the terrible shock to Dean Von Kleist, canon of the cathedral in Cumin, in Pomerania, 1746; "Identity of Lightning and Electricity," representing Benjamin Franklin performing his celebrated experiment of 1752; "Beginnings of the Battery," Galvani's "Voltaic Cell," with Galvani's famous frog experiment, 1791, and the "Beginnings of Modern Dynamo-electric Machinery," showing Michael Faraday's famous experiment, 1831. These tableaux are accompanied by a descriptive lecture by Dr. Park Benjamin on the early philosophical, technical and electrical books, each illustrating some feature or stage of electrical evolution.

Another feature will be an exhibit of the work of the students of the Hebrew Technical Institute, including a small electric-lighting plant complete and shown in operation in lighting a small house. Mr. Charles Chamberlain has been placed in charge of the gas features of the Electrical Exhibition.

In consequence of the illness of Prof. Sidney H. Short, and the fact that so many of the members of the society are engaged in active work on the electrical exhibition, it has been decided to give Prof. Short's lecture on "The Outlook of High Electric Traction" during the exhibition next month. At the electrical exhibition there will be various demonstrations of scientific phenomena and principles by means of models and apparatus, which will be in more or less continuous operation. As the society has been entrusted with a great deal of the work of this kind, it would like to secure from among its members the help of volunteers to take charge of various features for a time, so that the duty will not be heavy, but will be made as light as possible. The first applications will be selected, preference being given, as far as possible, in case there are a large number of applications, to students of educational institutions. The assignment to duty will be in the hands of a committee of the society and the Exhibition company, and the work of such members will be publicly recognized.

The Long Island Railroad company has made arrangements to give electric service during the time that the East River tunnel is being constructed. A contract has been entered into with the owners of the Brooklyn elevated railroad to run a through service from Coney Island over the surface lines of the Long Island railroad and the Fifth Avenue line of the Brooklyn elevated railroad to Brooklyn bridge. The elevated road at the Flatbush avenue station will be connected with the terminal of the main line running to Jamaica, giving through service to this route. Another line will be equipped running from Jamaica and Rockaway Beach by way of East New York and the Broadway line of the Brooklyn elevated road to the Broadway ferry. The tracks of the elevated road will be extended over both the Brooklyn bridge and the bridge now building.

It is possible that the streets in the borough of Queens may be left in darkness before many days. The contracts for street lamps are expiring and the city has so far declined to recognize the many contracts rushed through for electric lighting in the last days of the year. The only contract for electric lighting so far approved is that for Long Island City, which calls for $78,800 a year. Flushing, College Point, Whitestone, Hollis, Far Rockaway, Arverne, Rockaway Beach, Jamaica and other villages will have to do without street lights. The estimated cost of lighting the entire borough is $400,000 a year, and the Board of Estimate and Apportionment has rejected the estimate.

The Metropolitan Street Railway company is experimenting with compressed-air motor cars, designed to run indifferently over horse, cable or electric-railway tracks.

W. F. O.

PERSONAL.

The many friends of W. L. Arnold, both in Chicago and his old home, St. Louis, will be interested to know that he has recently accepted with the Siemens & Halske Electric company of America the position of district sales agent, with headquarters in the Monadnock block, Chicago. As is well known, Mr. Arnold represented the General Electric company in St. Louis in a most creditable manner. He severed his connection with that company to push the Arnold power transmission system. Mr. Arnold is a man of many friends, particularly in the West and Northwest, and he cannot fail to prove a most valuable man to aid in carrying out the present aggressive policy of the Siemens & Halske company.

ELECTRIC RAILWAYS.

The Springfield (Mass.) Electric Street Railway company has petitioned the railroad commissioners for authority to issue $300,000 additional capital stock to extend and rebuild the lines.

The Peekskill Traction company has been incorporated to operate a 12-mile electric freight and passenger railroad in Westchester County, New York. The company is capitalized at $150,000.

The corporation of Manchester, England, has, it is said, decided to buy the street railways of the city and work them by electricity on the trolley system. It already possesses an electric-lighting system.

A charter has been issued to the Monongahela Street Railway company of Pittsburg (capital, $30,000). The line will run from the city line on the north side of the Monongahela river, on the Pittsburg and Homestead bridge, to Schenley Park bridge, five miles. The incorporators are J. G. Woods, F. M. Rose, C. T. Marsh, C. F. Farren and W. S. Mitchell.

It is announced that trolley lines will be constructed east and west of Utica, N. Y., which will give a system of rapid transit from Little Falls to Rome, a distance of 40 miles. The Delaware Electric Railway company, which contemplates running a trolley road between Milford, Dover and Woodland Beach, has closed the contract for building the road and work will soon be begun. The road will be 38 miles in length.

A sensation in the receivership proceedings of the Terre Haute Street Railway company was created on April 21st by a circular letter of invitation for a meeting of creditors. The letter is signed by the First National Bank, Stanley Electric company, Western Electric company, American Electrical Works, Illinois Steel company and John A. Roebling's Sons company of Chicago. It is said in the circular that the affairs of the company are much involved and that there is need of an investigation of the cause of this condition. The proposed investigation is to cover the period of Russell Harrison's management.

Electrical features of unusual interest are to be associated with the new equipment of the Lewiston (Me.), Brunswick and Bath railroad. Generators to supply alternating and direct currents simultaneously are to be located in Brunswick, Me., the initial installation being 1,000 horse power. Direct current is to be used at the sections of railroad in and about Brunswick, and the alternating current is to be stepped up to 10,000 volts and transmitted to sub-stations at Lewiston, Bath and Lisbon Falls. Here rotary transformers convert the alternating current into direct current for the feeders. Westinghouse apparatus will be used.

The underground trolley cars on Second and Fourth avenues, New York, are a great improvement on the old horse cars, and are highly appreciated by those who ride in them, but the Sun points out that the speed at which they run, and which is one of their chief attractions, has added a new peril to the lives of pedestrians. Their record of slaughter has not yet begun to equal that of the Brooklyn trolley cars, and the mischief they have as yet done has been confined chiefly to collisions with other street cars and with trucks and carriages, but they are none the less a constant source of terror to the

nervous and the timid. What with them, with the Broadway cable cars, and with the multitude of swiftly darting bicycles which crowd the thoroughfares, the New Yorker who goes on foot has to be every moment on his guard against being knocked down, if not killed.

The efforts of rival trolley lines to secure additional territory in Westchester County, New York, resulted in an open conflict last week, when about 200 men employed by the New York, Westchester and Connecticut Traction company began constructing a double track to connect Mount Vernon, New York city and Pelham Manor. This territory is on the Boston post road, and is better known as "No Man's Land," because of numerous disputes concerning the boundary. The Union Railroad company requires only the strip through "No Man's Land" to connect its lines in Mount Vernon, East Chester, New York, Pelham and New Rochelle. It is said that the Westchester company learned that this was about to be done and that company revived an old franchise, given three years ago, took possession of the post road and began to build just outside the limits of the Manor. A dozen mounted policemen from the Wakefield station ordered the builders to show permits from the Building Department. On the failure to do so six policemen and a roundsman were placed on guard to prevent further operations. The next morning 200 Italians arrived and by night completed 900 feet of track in the territory beyond the jurisdiction of New York city.

TECHNICAL SCHOOLS.

The sixteenth annual catalogue of the Rose Polytechnic Institute of Terre Haute, Ind., has been issued. The course in electrical engineering is described and the apparatus in the plant and laboratory is enumerated. Dr. Thomas Gray is the director of the mechanical and electrical engineering departments, and Frank C. Wagner is the associate professor.

ELECTRICAL SECURITIES.

The annual meeting of stockholders of the General Electric company will be held at Schenectady on May 10th.

The annual stockholders' meeting of the Mexican Telephone company will be held May 11th in New York. Stockholders of record on April 21st will be entitled to vote.

The Albany Railway company reports for the quarter ended March 31st: Gross earnings, $145,584, an increase of $20,227; operating expenses, $96,393, an increase of $2,497.

The Binghamton Railroad company reports for the quarter ended March 31st: Gross earnings, $32,973 and operating expenses $23,688; net earnings, $9,285, an increase of $3,115.

The Edison Electric Illuminating company of New York reports gross earnings for March of $263,975, an increase of $56,105 as compared with the same month last year, and net $113,223, an increase of $18,805. For the three months ended March 31st the gross earnings were $819,163, an increase of $158,190 as compared with the corresponding period of last year, and net $378,186, an increase of $53,216.

The Herkimer County Light and Power company of Herkimer, N. Y., with a capital of $400,000, has been formed by the consolidation of the Herkimer Gas Light company of Herkimer, the United Gas and Electric Light company of Little Falls and the Ilion and Mohawk Valley company of Ilion. The directors are William F. Cochran and Alexander S. Cochran of Yonkers, George E. Weed, Maitland F. Griggs, Thomas E. O'Shea, Henry Stanton, Robert A. O'Shea and James P. O'Shea of New York city, and Thomas Ringwood of Ilion.

MISCELLANEOUS.

The recently organized Union Carbide company of Niagara Falls has made arrangements whereby it will control the entire calcium-carbide output in the United States, the company having practically bought out the carbide companies in the country. It has been incorporated under the laws of West Virginia, with a capital stock of $6,000,000. It is understood that with the exception of three factories all those acquired by the company will be closed, and that the operations of the company in the manufacture of carbide will be centralized. The three factories to be continued in operation are located at Appleton, Wis., Sault Ste. Marie, Mich., and at Niagara Falls. The Niagara Falls plant is to be greatly enlarged and continuous furnaces are to be installed, the work now being in progress. This requires a general overhauling of the plant in all its parts. The officers of the new consolidation are: President, Charles F. Dietrick, New York; vice-president, George O. Knapp, Chicago; secretary-treasurer, A. B. Proal, New York; assistant secretary-treasurer, E. J. E. Ward, Chicago; general sales agent, A. H. Mulliken. All the carbide sold in the United States will be through Mr. Mulliken.

TRADE NEWS.

The Union League Club of Chicago has determined to newly wire its entire building and reconstruct its switchboard. The work will be done by the Chicago Edison company. Mysenburg & Badt are consulting engineers.

The new Illinois Electric company of Chicago has secured the agency for the weatherproof, annunciator, office and magnet wire made by the Crefield Electric Works of Saylesville, R. I. A complete stock of all sizes will be carried.

War talk applies to fan motors, or at any rate to those cleverly advertised by the Central Electric company, which says that its motors constitute "an invincible line of ironclads for hot-weather defense," and that they have "passed through many a siege unscarred."

The bulletins of the Warren Electric Manufacturing company of Sandusky, O., are a credit to the establishment. They are pithily written (as might be expected), clearly illustrated and issued in convenient shape for filing. The Warren alternator is described and its workmanlike simplicity pointed out. The names of users and fac-simile testimonials are also given.

For the first time in its history the Standard Underground Cable company is compelled to do Sunday work at its factory in Pittsburg in order to complete large government contracts for submarine and underground rubber insulated cables, to be used for the purpose of defending the approaches to the various harbors along the Atlantic and Gulf coasts. These cables are to be used in making connection between the land and the submarine torpedoes and mines that are to be operated by electricity. Notwithstanding this large work, the company expects to keep up with its regular orders by continuing to run the factory 24 hours a day.

The many friends of George Cutter throughout the West, and Chicago in particular, will be interested to know that Mr. Cutter is once more in his element, so to speak, in the possession of a fine establishment on Lake street, from which he is now able to carry out his fondest plans along the line of the development of novel electrical specialties. For a long time Mr. Cutter's friends have urged him to aggressively push the development of the business for which he is so well fitted, that is, the production of unique and novel electrical specialties, and from all accounts Mr. Cutter is now in a position to actively push this business for which he is so well fitted.

The Walker company will exhibit at the Madison Square Garden show two of its No. 20-L motors, mounted on truck; one No. 20 L motor, dismantled to show construction; two No. 4-A street-car motors, mounted; one 50-kilowatt belted lighting dynamo, direct-connected to Armington & Sims engine, complete with switchboard; type "S" controllers, assembled and dismantled; railway switchboard, complete with feeder and generator panels; ornamental arc lamps; new Walker recording wattmeter and a large display of photographs of its apparatus. Besides this there will be a complete section of the new underground conduit, with a Broadway car shown in operation.

Eugene Munsell & Co. and the Mica Insulator company of New York and Chicago have completed arrangements with the George Worthington company of Cleveland, whereby the latter becomes distributer of both mica and micanite. The factory includes those of Cleveland and some eight or 10 of the adjoining counties. A large stock of India and amber mica, in the sheet and segments for railway motors, as well as micanite plate, segments, rings, cloth, paper, etc., will be kept to supply the electrical trade in that section. This is an important step in the right direction, and the trade in Cleveland and vicinity will appreciate the fact that this stock has been placed in the hands of so large a company, which has the facilities for making prompt delivery.

Within the last three years the Westinghouse Electric and Manufacturing company has installed over 100,000 horse power of polyphase generators, ranging in size from 10 to 5,000 horse power each. Judging from the orders at present on hand, the Westinghouse company will install more than 100,000 horse power of this type of generators alone during the coming year. A single order now on its books calls for 75,000 horse power. Polyphase motors have also been made in large quantities, ranging from 1 to 500 horse power, two of the latter being for the Niagara Falls Electric Light and Power company, where they are utilized to drive the dynamos for lighting the town, power being supplied to the motors by the 5,000 horse power Westinghouse Niagara generators.

A new catalogue, or rather a new edition of a catalogue, of importance to the electrical trade is that on electric-light supplies, just issued by the Western Electric company. This is a neat cloth-bound volume of 560 pages. It is of very convenient size to handle, the pages being 7¾ by 5½ inches. The arrangement of this catalogue is good; nearly every article listed is illustrated by a marginal cut. The printing and paper are fairly good, and although the type is smaller than is customary, it is legible. The catalogue seems to be full and complete, and a carefully compiled index adds greatly to its value. Prices and code-words are given, with brief descriptions of the articles in many cases. Copies of the book will be furnished to the trade upon application. It is said that the weight of the entire edition is 20,000 pounds.

The Gordon-Burnham Battery company of New York will be in its new quarters on May 2d. The new location is at 594 Broadway, where the company has leased large floor space to accommodate its increasing business. The business of this company is said to have been twice as large in March, 1898, as in March, 1897. The company reports that it finds it a little hard to get a high grade of zinc, which it requires in the manufacture of the batteries, as so much of the metal is taken up by the brass manufacturers in the manufacture of wire material. But, fortunately, it has made a number of large contracts for zinc, which will insure a supply for many months to come. The rapid growth of the Gordon-Burnham Battery company's business since General Manager A. S. Pinkham has been in charge of affairs is a good illustration of what hard work and close application to business will do.

A new firm has appeared at 141 South Clinton street, Chicago, under the title of Cass & Aaron. This institution has a nice shop and is prepared to do repairs of all sorts. Armatures and fields will be repaired and rewound, and commutators will be rebuilt and refilled, and all work will be guaranteed. In fact, the institution is prepared to do every class of electrical repairing and is also in the new and second-hand dynamo and motor business, and will carry in addition to a stock of new and second-hand dynamos and motors, arc lamps and transformers. They will buy, sell and exchange and also stand freight or cartage one way on all repair work, and are equipped to work day and night if necessary. Both Philips C. Cass and Jacob Aaron, the members of the firm, are men and eminently fitted to carry on this business with success. Mr. Cass has traveled on the road for a number of years as expert throughout the West, and Mr. Aaron is also well known in Chicago as a mechanical expert.

BUSINESS.

The Ericsson Telephone company, formerly located at 10 Warren street, New York, has removed to 20 Warren street.

The Dearborn Drug and Chemical Works of Chicago have issued booklets showing the importance of analyzing and treating boiler-feed waters and also the necessity of using good lubricating oils.

The Globe Carbon company's catalogue of carbons for motors, batteries, telephones and lamps is convenient in form, well arranged and handsomely illustrated. The company's factory at Ravenna, O., is said to be the most complete of its kind in the country, and the new catalogue shows several improved battery elements and cells and other specialties.

The Knapp Electric and Novelty company of 47 Warren street, New York, has made arrangements with the Gordon Battery company of Chicago, that city, to provide it with its larger size fan motor, to be used in connection with the Gordon batteries. This arrangement will in no way prevent the sale of the Knapp fan motor separately, and in any quantity that the trade may desire.

The Electric Appliance company has increased its line of enclosed Unique lamps by the introduction of a new enclosed lamp for alternating work. This lamp is giving satisfactory results and gives promise of being equal in every respect to the direct-current enclosed lamps. The Electric Appliance company has all of these lamps burning in its store, and it has been commented on favorably by all who have watched its operations.

The John Stephenson company has just awarded the Sprague Electric company another large contract for Lundell power motors with which to equip its blacksmith and machine shops. Considerable interest is attached to the exhibit of the electric-elevator machine for the London underground railway, which is to be shown at the electrical exposition to be held in Madison Square Garden, New York, commencing May 2d. The Lundell motors of this type are the largest elevator machines ever built, and were made by the Sprague Electric company.

The Lynn Incandescent Lamp company of Lynn, Mass., is said to be the largest and oldest of the companies making a specialty of renewing burned out lamps. The company has the wisest business shown that nine out of 10 of its shipments are to old customers and that five out of eight are to lighting stations. This condition of affairs seems to demonstrate that station managers are appreciating the company's efforts to furnish them with a good lamp at reduced cost and that the company is making it possible and profitable for the station manager to use lamps of higher efficiency and replace them oftener.

One of the specialties of the Holtzer-Cabot Electric company of Boston that is attracting attention is the Ness automatic intercommunicating telephone switch. Intercommunicating systems are convenient, but in the usual manual switches, where the switch must be returned to its normal position

by hand after each call, the frequent omission of this duty on the part of somebody using the instruments resulted in unsatisfactory service. The Ness automatic switch entirely overcomes this trouble, as it is arranged so that the replacing of the receiver upon the hook causes the switch to fly back to its own point. The hook and all the switch connections are mounted upon the door, and provision is made for placing the induction coil and transmitter upon it also. The connections are all wired across to the bottom of the box. This permits opening the instrument up without disconnecting or disarranging any of the parts.

Those in the electrical trade interested in seeing the headquarters of what has been referred to as one of the largest electrical supply houses in the world might do well to drop in and inspect the new headquarters in Chicago of the Central Electric company. This concern arranged early this year to occupy larger quarters, owing to the continued increase in business, and the spacious store on the ground floor extending from 264 to 270 Fifth avenue was selected as most suitable for the growing needs of the company. This commodious emporium for electrical goods has an 80-foot front and extends back as far as 140 feet to an alley, which in size is almost a street. Below the store proper is a cellar, which will be employed as a storehouse, lighted with luxfer prisms and provided with cement floor and good ventilation. It is a storeroom well fitted for the heavier portions of the company's large stock. On entering the door the customer finds himself with the store proper directly in front and an assorted stock room off of the left, with the general offices occupying the best lighted portion of the front of the remainder of the store. The back of the store proper, from which the counter trade will be supplied, is the shipping department, well provided with elevators and other conveniences with which to facilitate in every way the expeditious delivery of goods to drays and wagons in the rear commodious alley. It is, however, really impossible to appreciate the care that has been taken in arranging the different departments of this supply house for executing the plans of the company. Its motto is "Large Chicago stock and promptest shipments." The company expects to have the store in readiness for trade as early as May 1st. Meanwhile business continues and will continue as though there was no change of headquarters in progress.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 19, 1898.

602,429. Volve Controller. Arthur E. Colgate, New York, N. Y. Application filed September 19, 1896. Renewed October 1, 1897.

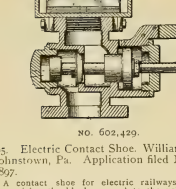
The valve stem is provided with an actuating piston working in a separate chamber and adapted to be actuated by the pressure from the inlet to open the main valve; there are a passage from the inlet to the chamber, an auxiliary valve for controlling the passage, an electromagnet for operating the auxiliary valve, a practically water-tight casing for the magnet, a plate mute and connected tube, through which extends a rod from the armature to the stem of the auxiliary valve, and a packing at the outer end of the tube.

602,434. Signaling Device for Railway Cars. Frank W. Diehl, Detroit, Mich. Application filed September 28, 1897.

The circuit-closing device described comprises a casing adapted to be secured to the car above the heads of the passengers and provided with openings in the top and front, the insulated pivoted contact lever having one end projected through the front opening, the insulated contact plate secured inside the casing in the path of the movement of the lever, the insulated spring for normally holding the lever and plate apart, the circuit wires entering the casing through the top opening and connected respectively to the lever and contact plate, and a cord attached to the projecting end of the lever and depending in reach of the passengers.

602,463. Trolley Wire Hanger. William A. McCallum, Cincinnati, Ohio. Application filed August 16, 1897.

One claim is reproduced: In a line hanger of the character indicated, the combination of the holder, the screw cap having its inner face provided with teeth or corrugations adapted to engage by backward rotation of the screw cap, the insulated bolt seated in the holder and provided with teeth or corrugations corresponding with those of the cap, and the interposed compressible disk.



NO. 602,429.

602,495. Electric Contact Shoe. William M. Brown, Johnstown, Pa. Application filed November 14, 1897.

A contact shoe for electric railways is described, comprising the block secured to the vehicle to be propelled, the hose secured to one side of the block, and the contact strip secured to the hose.

602,527. Electrical Measuring Instrument. Herbert W. Sullivan, London, England. Application filed November 6, 1896.

This instrument has an oscillating coil, a core therefor and magnets in whose field the coil oscillates, having poles with pointed extremities brought into close juxtaposition with portions of the core without interfering with the movements of the coil.

602,557. Alternate-current Meter. Clarence P. Feldmann, Cologne, Germany. Application filed December 21, 1897.

Where there is no direct supply of current to the movable armature, a thin layer of magnetic material is proposed, with the armature of the brake body connected to the same for the purpose of creating a differential effect of such dimensions that a fixed zero position is produced, the sensitiveness of the meter remaining practically unaltered.

602,548. Electric Controller for Gas Regulators. William E. H. Williams and Paul Seiler, San Francisco, Cal. Application filed May 13, 1897.

An electro-magnetic lever is provided for removing the supplemental weight, and an electric circuit extends to a distant point energizing the electro-magnetic devices, and a switch is arranged in the circuit at the distant point, controllable at the will of the operator independently of the gas pressure.

602,564. Insulated Pneumatic Tube. George Peeples, Philadelphia, Pa. Application filed June 19, 1896. Renewed October 5, 1897.

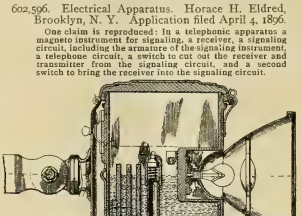
A joint comprising an upper section is connected to but insulated the gas pipe and has notches in its reverse end, a lower section has on its upper face a series of grooves or channels registering with the notches, and means are provided for connecting the two sections together.

602,584. Electric Railway. Hosea W. Libbey, Boston, Mass. Application filed December 10, 1894.

The arrangement includes two rows of parallel alternately arranged bars insulatingly embedded in the cover of a conduit, a supply wire within the conduit, movable conductors between the wire and the bars, and a magnetic trolley, the free end of which is provided with two wheels, one upon each side thereof, and each in electrical connection therewith.

602,596. Electrical Apparatus. Horace H. Eldred, Brooklyn, N. Y. Application filed April 4, 1896.

One claim is reproduced: In a telephonic apparatus a magneto instrument for signaling, a receiver, a signaling circuit, including the armature of the signaling instrument a telephone circuit, a switch to cut out the receiver and transmitter from the signaling circuit, and a second switch to bring the receiver into the signaling circuit.



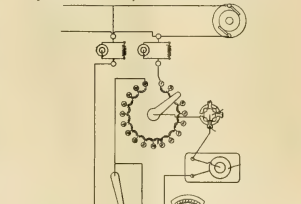
NO. 602,616.

602,616. Invertible Fluid Battery. Porteus R. Cunningham and Charles H. Howland-Sherman, Washington, D. C. Application filed February 20, 1897.

The battery box comprises an open, cylindrical vessel of non-conductive material, formed integrally with a central partition, dividing the vessel into two compartments or cells, an inner chamber or recess, opening exteriorly of the vessel, parallel and vertical spacing ribs projecting interchyl from the walls of the partition and recess or chamber, electrodes fitting between the ribs, the diametrically opposite undercut lugs projecting from the walls of the partition and of the vessel, and clamps engaging with the lugs and with the tops of the electrodes to fasten them in place.

602,667. Railway Switch-operating Mechanism. Charles W. Squires, Springfield, Mass. Application filed November 8, 1897.

The device is electrically operated, the principal feature being the combination with the railway track having the switch and the insulated track section, the return wire and a switch-operating device, of a reversible actuator or engagement member coacting therewith, an electro-magnet and an armature lever, a current conductor in connection with the insulated track section and with a magnet, a current connection running from the magnet to connection with the return wire, and the shifter movably mounted on the armature lever, and bodily movable therewith, cooperating with the actuator to successively reverse it, and an abutment which the shifter engages each time it is reciprocated bodily by the armature lever, whereby its own position is successively reversed.



NO. 602,709.

602,678. Traveling Contact for Underground Electric Railways. Griffin B. Coleman and Joseph W. Duggan, Washington, D. C. Application filed November 2, 1897.

The traveling contact or current collector for underground electric railway systems is claimed in connection with two pairs of lead wires provided with independent couplings and independently connected to the contact shoes of the device.

602,709. Apparatus for Reducing Electric Currents and Voltage. Alexander F. Vetter, Long Island City, N. Y. Application filed September 3, 1895. Renewed November 13, 1897.

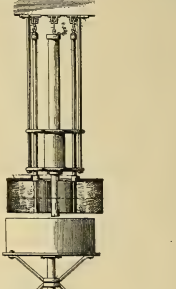
In apparatus for reducing currents and voltage there is the combination with the supply circuit, of resistance controlling the current strength, a second resistance placed in the supply circuit, a shunt circuit including translating devices, and means for transferring a portion of the second resistance of the supply circuit to the shunt circuit.

602,774. Electric Muscular Exerciser. Eugen Sandow, London, England. Application filed January 24, 1898.

The combination is claimed with an elastic cord exerciser, of handles attached to the cords of the exerciser, wires attached to the handles and extending the length of the cords, being so united with the cords as to be capable of extending with them so as not to interfere with the elasticity thereof.

602,746. Street Indicator. Edgar J. Hall, St. Louis, Mo. Application filed November 3, 1897.

This device comprises a dial, a hand adapted to travel over the dial, a spring gearing, a battery, a magnet connected with one pole of the battery, a spring arm carrying an armature over the magnet, a notched disk controlled by the arm and operated by the gearing, a trolley wire provided with a spur, a trolley rod, a plate mounted on the trolley rod, a contact plate and spring pawl mounted on the rod plate and connected with the other pole of the battery and with the magnet.



NO. 602,817.

602,747. Process of Smelting Phosphorus. Charles Knox Harding, Chicago, Ill. Application filed April 5, 1897.

The form of electric furnace may be varied, although the essential features are the same, namely, the tubular cathode located so as to be normally covered by a mass of material to be operated on, the carbon slabs forming the lining of the crucible, the supply of hydrocarbon and the regulating mechanism whereby the arc is governed by automatically controlling the supply of hydrocarbon.

602,767. Electric Switch. Arthur G. McPherson, Highland Park, Ill. Application filed May 1, 1897.

A device for the purpose described has in combination two isolated contacts, each adapted to be connected with one limb of an electric system, a longitudinally shiftable contact piece adapted to connect alternately with the contacts and being in electrical communication with another limb of the system, an oscillatory lever or handle pivoted at a point between the contacts, an elastic connection between the lever or handle and the shiftable piece, and means for retarding the movement of the shiftable piece while in electrical communication with either of the contacts.

602,815. Electric Furnace. George G. Clark, Galveston, Texas. Application filed February 3, 1897.

A revolvable fusing pot is described having an electrical connection therewith, a carbon electrode supported above the pot, and means for automatically drawing or feeding the material inward toward the carbon electrode as the fusing pot revolves.

Western Electrician.
EVERY SATURDAY.
Vol. XXII. CHICAGO, MAY 7, 1898. No. 19

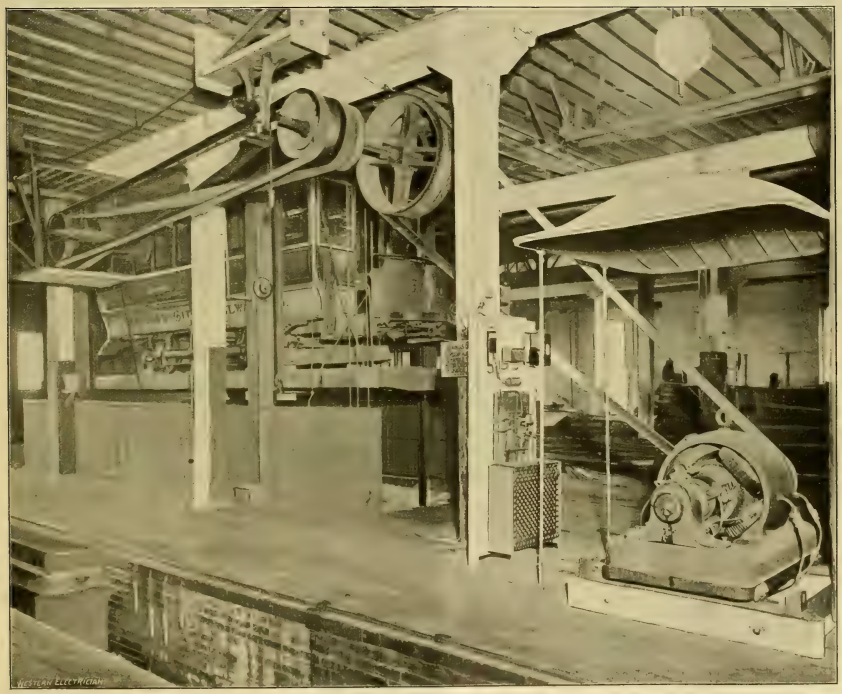
Electric Elevator for Hoisting Trolley Cars.

Modern methods in the management and operation of street-railway properties have introduced many features that were unknown in the days of animal power. For instance, experience has shown that it is economical to establish and maintain a department for frequent inspection of motor cars, and this is particularly true of large corporations, where many cars are in constant service. It is only by systematic effort and close attention that rolling-stock can be kept in first-class condition and the best returns secured from the system.

The introduction of mechanical propulsion on the lines of the Chicago City Railway company directed the attention of the management to this subject at an early day, and that corporation immediately established a machine shop in the old horse-car barns between Twentieth and Twenty-first streets on Dearborn street, back of the office building and power house on State street. The scope and character of this branch gradually expanded until it now comprises one of the best equipped street-railway shops in the country. The entire building is occupied by the mechanical department, and every class of street railway construction and repair work is carried on there. Many labor-saving devices have been introduced, and although the building was not intended originally for such purposes, it has been remodeled and arranged so that, with the aid of modern machinery, excellent results are obtained.

The latest addition to the equipment of these shops is an electric elevator for hoisting and lowering the heavy electric and cable cars. The inspection department and car shops are in the upper part of the building, and the cars that need attention are run in from the street level and hoisted by the electric elevator to the floors above, where they are carefully examined and repaired or cleaned and painted if necessary.

The elevator equipment and the dimensions and capacity of the car are of such unusual character as to attract considerable attention. The picture on this page shows a trolley car of the standard size and weight of those operated by the Chicago City Railway company on the platform of the elevator half-way between the first and second floors. The dimensions of the platform are 10 feet by 31 feet 11 inches, and its carrying capacity is 10 tons. It is operated at a speed of 14 feet 3 inches per minute. It will be seen from the picture, which is a half-tone reproduction of a photograph, that the elevator is constructed in a substantial manner and is well-adapted for this work. It will be noticed that there is a fence built on either side of the elevator shaft to prevent workmen from getting under the car when it is raised to the floors above. This precautionary measure, it is hoped, will prevent accidents such as at the same time keep the enclosure free from all obstructions.



ELECTRIC ELEVATOR FOR HOISTING TROLLEY CARS. VIEW OF APPARATUS EMPLOYED IN CHICAGO CITY RAILWAY COMPANY'S SHOPS.

The mechanical features are simple, and a glance at the illustration will show the method of operation. The elevator equipment is of the standard make of the Eaton & Prince company of Chicago, and the electric motor is a 30 horse power machine built by the Card Electric company of Mansfield, Ohio. It is wound for 500 volts and is operated at 735 revolutions per minute. The field core is cast in one piece, making a perfect magnetic circuit without joints or planed surfaces; the armature shaft is of the best steel, forged within one-fourth inch of the finished size; the armature is slotted, with four-pole winding; the commutator is made of tempered copper, drop forged to gauge, and the armature and commutator are insulated with the best of mica. All bearings are self-oiling and self-aligning. There is no external magnetism; the regulation is automatic, the efficiency high and the point of commutation constant from no load to full load. The rheostat with starting switch is shown in the cut. It is placed at a convenient point so that the operator can see the elevator and be near the motor at the same time.

Mr. E. C. Moore, the master mechanic of the Chicago City Railway company, designed the equipment and supervised its construction and installation. He is well pleased with the results thus far obtained. The elevator runs smoothly and it is believed will prove economical and efficient.

The Western Union Telegraph company has subscribed $5,000 to the stock of the Omaha Exposition, and the Postal Telegraph company has subscribed $1,000 for the same purpose.

Electrical Exhibition in New York.

The opening of the great electrical exhibition now on in Madison Square Garden, New York, took place successfully on Monday night. After an overture by a band, Chancellor McCracken of New York University offered prayer, and then Dr. Pupin stepped forward and requested Dr. Chauncey M. Depew to preside. The opening telegram from President McKinley was in the following words:

"It gives me great pleasure to open the electrical exhibition in Greater New York and to participate in this wonderful demonstration of the latest method of recording and publishing by means of electricity. I congratulate you upon the achievements of American genius. I am glad to know that the resources of the wonderful electrical arts have already been so far advanced in the United States that American electrical goods are welcome the world over."

The exhibition open with the president's telegram, a message was received from Vice-president Hobart, and congratulations were also tendered by the governors of New York and New Jersey. Dr. Depew delivered an oration and Miss Hilks sang "The Star-spangled Banner," the great audience joining in the chorus.

In his address Dr. Depew allowed himself great latitude in his choice of topics. He touched upon the development of electrical science in the last century, and pointed out how much it had done to promote civilization. But before he knew it he was discussing Dewey's victory at Manila, proposing cheers for the commander of the Pacific fleet, for pure plumbago dynamo and motor brushes, in addition to its new arc-light carbons, which are said to be equal to the imported.

The Universal Electric company of New York displays under the supervision of Wood, Shaw & Co. the Universal non-arcing lightning arrester for light and power for direct and alternating circuits.

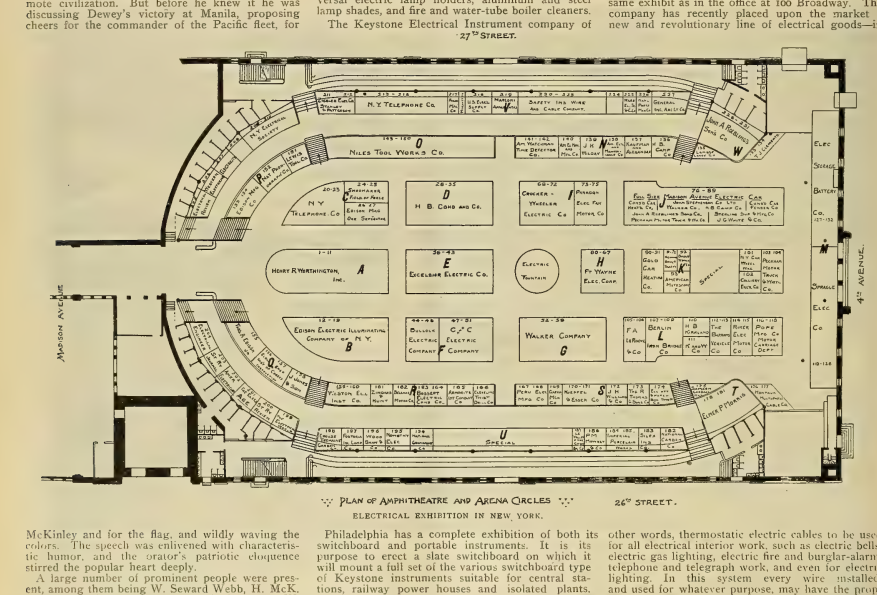
The O. S. Platt Manufacturing company of Bridgeport, Conn., shows the New England snap, indicator, flush, lock and push switches. Its exhibit is made under the supervision of Wood, Shaw & Co.

The Quaker City Electric company of Philadelphia makes a display under the supervision of Wood, Shaw & Co. of its latest designs of generators and motors, in addition to its rheostats and starting-boxes.

The Ward Leonard Electric company exhibits various styles of its automatic magnetic circuit breakers in sizes from a few amperes up to 2,000 ampere size. It also shows a variety of automatic rheostats and several forms of the well-known Carpenter enamel field rheosats.

The Faries Manufacturing company of Decatur, Ill., may be found on the Twenty-seventh street side of the building, on the promenade just above the main floor, adjoining the long-distance booth of the New York Telephone company. The company shows a general line of its goods, including Universal electric lamp holders, aluminum and steel lamp shades, and fire and water-tube boiler cleaners.

The Keystone Electrical Instrument company of



PLAN OF AMPHITHEATRE AND ARENA CIRCLES.

ELECTRICAL EXHIBITION IN NEW YORK.

McKinley and for the flag, and wildly waving the colors. The speech was enlivened with characteristic humor, and the orator's patriotic eloquence stirred the popular heart deeply.

A large number of prominent people were present, among them being W. Seward Webb, H. McK. Twombley, Henry B. Hyde, John E. Searles, J. W. Alexander, John Jacob Astor, General Louis Fitzgerald, Charles R. Flint, John D. Rockefeller, William Rockefeller, the Rev. Dr. Morgan Dix, ex-Senator J. Sloat Fassett, General Benjamin F. Tracy, the Rev. Dr. Lyman Abbott, President S. R. Callaway of the New York Central and Hudson River railroad, the Rev. Dr. Rainsford, Thomas A. Edison and Prof. F. B. Crocker.

The exhibition has many interesting features and is to last during the month. The officers and members of the New York Electrical society have devoted much thought and labor to its success.

The floor and gallery plans, with the names of the exhibitors, are shown by the accompanying cuts.

Notes of Exhibits.

A. D. French & Co. of New York make a showing of octagonal wooden poles, plain and treated, for electric-light and power use. This display is under the direction of Wood, Shaw & Co.

Wood, Shaw & Co. exhibit the Imperial lead and paper dynamo brushes manufactured under the supervision of H. M. Shaw, who is one of the pioneers in the dynamo brush business.

The Partridge Carbon company of Sandusky, O., exhibit, under the supervision of Wood, Shaw & Co. the various kinds of self-lubricating carbon and Philadelphia has a complete exhibition of both its switchboard and portable instruments. It is its purpose to erect a slate switchboard on which it will mount a full set of the various switchboard type of Keystone instruments suitable for central stations, railway power houses and isolated plants. The company also shows a full line of its new ground detectors and instruments specially designed for series arc-light service. Portable testing instruments are also displayed. A number of the new Keystone type "R" instruments, mounted on a panel board, are shown in practical service on a working generator circuit. This exhibit is under the charge of Elmer P. Morris of New York, but President J. E. Stevens will spend a considerable length of time during the month of May at the Keystone headquarters.

H. B. Coho, as agent for the Warren Electric Manufacturing company of Sandusky, O., has on exhibition an improved Warren alternator of 75 kilowatts capacity and intends to operate it with an 8-pole direct-current motor. This alternator is connected for double voltage. Half the capacity of the machine will deliver current, without the use of transformers, direct to 110-volt lamps; the other half will be connected up to a potential of 1,000 volts on current to be reduced by transformers. The machine will be excited by a late improved Warren direct-current dynamo, which is a bipolar machine, over-magnet type, and is of an entirely new design, combining many elements of extreme simplicity with exceptionally high efficiency. The alternator will be operated at a speed of 800 revolutions per minute, contains no brushes, collector rings or revolving armature, the current being taken from a stationary element of the machine.

The Bullock Electric Manufacturing company of Cincinnati had to give up its idea of exhibiting its motors on various machine tools. Both the Niles Tool Works and the American Tool Works company, upon whose tools the Bullock motors were to be placed, and the Bullock company itself, have been so rushed with orders that were imperative, that they could not give the necessary time to these exhibit machines, and machines built on these orders have been turned over for immediate delivery. The exhibit now consists of one 25-kilowatt engine-type generator, one 25-kilowatt belted generator, one 10 horse power type "N" enclosed motor and one type "T" controller. The controller is from a recent design, and the 10 horse power enclosed motor is of absolutely new design, being the first turned out on this pattern. It is entirely enclosed, being dust and waterproof, and is designed for use in foundries, on cranes, pumps, etc.

The Montauk Multiphase Cable company of New York displays its new automatic thermostatic interior electric cable in a booth located in the northeastern section of the garden, at the junction of the outer aisle parallel with Twenty-seventh street and the outer aisle parallel with Fourth avenue, some of its neighbors being the Electric Storage Battery company, the Sprague Electric company and the Peckham company. The purpose is to make the same exhibit as in the office at 100 Broadway. The company has recently placed upon the market a new and revolutionary line of electrical goods—in other words, thermostatic electric cables to be used for all electrical interior work, such as electric bells, electric gas lighting, electric fire and burglar-alarm, telephone and telegraph work, and even for electric lighting. In this system every wire installed, and used for whatever purpose, may have the property of discovering dangerous heat or flame in its vicinity, notifying the existence of the excessive heat at any and all points desired, both locally and at the central station. The company makes an exhibit of both local and central-station work, the latter in connection with the telephone district service boxes, thermostatic devices, auxiliary fire alarm boxes and all other electrical transmitting devices. The Montauk Multiphase Cable company manufactures the only automatic thermostatic electric cable in the world, and it is its purpose to bring out all its salient points in connection with every interior device now used by the public.

In a recent article on foreign trade in Russia, showing German enterprise and the possibilities for Americans, it is stated that the "technical bureaus" of the large German manufacturing firms keep a stock of every type of machinery, which is constantly renewed according to sales effected. Take, for instance, the bureau of the Allgemeine Elektricitäts Gesellschaft, Berlin, which is conducted by the engineer, Mr. Seiherbatd. Everything this large concern, whose capital is $25,000,000, produces at home may be found there. This bureau has been established for account of the company, which allows the manager a commission of 10 per cent and pays all expenses of the bureau.

General Electric Company's Annual Report.

The annual meeting of the General Electric company will be held at Schenectady, N. Y., May 10th, at which time 13 directors will be elected for the ensuing year, the annual reports of the president and several vice-presidents will be received and the condition of the business explained.

President Coffin's report is a general review of the year's business, the details of which are considered in the department statements. The president's report is appended:

The past year witnessed a revival in business, which increased rapidly in activity and volume during its latter months.

In the last annual report attention was called to the fact that your company began the year with less orders on hand than previous seasons. As a result of this, the actual output of your works has been slightly smaller than in previous years, although the orders received during the period have shown a marked increase. This increase will be reflected in the shipments of the ensuing year.

A careful scrutiny of the assets of your company, other than its patents, leads to the belief that previous values were conservatively fixed, and no changes of any significance have been necessary.

The patent account of the company has been kept at substantially the same amount on its books since the organization of the company. The question of a revaluation of patents is one to which consideration should be given at the proper time.

Business of the Year.

Gross earnings	$12,524,938.07	
Less expenses	10,727,692.02	
		$1,797,216.05
Interest and discount, and interest and dividends received on securities owned	389,789.16	
Less interest on debentures[1]	333,333.35	
		56,455.81
		1,853,701.86
Deduct amounts written off		
Sundry losses and allowances for possible losses	79,220.42	
Patents and patent expenses	33,334.68	
Inventories and consignments..... ..	[illegible]	
Reserve for extensions to factory plants..	250,000.00	
	752,220.80	
Less profit on securities sold and debentures canceled.. . .	[illegible]	
		621,849.49
Reduction of the deficit of previous years		$1,231,852.37

In addition to the purchase of $2,000,000 of debentures referred to in previous annual reports, your company has purchased during the year just ended $2,000,000, and the entire $[illegible] have been destroyed. Since the books were closed $[illegible] additional have been acquired, and are now held in the treasury of the company.

An increase is shown in the amount received from interest and dividends from securities owned. It is expected that the income from this source will still further increase from year to year, unless considerable sales of such securities should be made by the company.

The growth of your business has made it necessary to make further expenditures for additions and changes at your factories and in acquiring much additional machinery.

Plans have been prepared and contracts partially closed for a new foundry and a large and important machine shop, the largest building yet erected by your company.

In anticipation of the investment in the construction and equipment of these new shops, which it is estimated, will cost about $[illegible], the sum of $[illegible] has been deducted from the profit of the past year and carried to factory reserve account.

It has been the practice of the company to write off the amounts expended for additional factory facilities. It is thought that these allowances are not more than are required to properly provide for depreciation in all your factory plants taken as a whole.

At the annual meeting of the stockholders held four years ago the question of reducing the company's share capital in the manner prescribed by law was referred to the directors. Since that time the matter has had the earnest attention of your board, and it is their hope that a plan will be submitted for your consideration at an early date, designed to provide for a suitable reduction of the share capital of the company, with a view to the resumption of dividends.

The Patent Situation.

The patent situation has not materially changed since the last report to the stockholders. The company has secured many important patents during the year, by inventions of its engineers and experts and by purchase.

One of the Van Depoele trolley patents which had been uniformly sustained by the courts up to last summer has been adversely passed upon by the Court of Appeals for the Second Circuit. This decision was on a motion for preliminary injunction and is not final. The invention was an important contribution to the electric railway art, and no court has questioned its great merit. There is reason to believe that the technical objections to the claims of the patent, upon which was based the decision of the Appellate Court overruling that of the Circuit Court in favor of the patent, will be found upon full consideration at final hearing to be insufficient to defeat the patent.

In view of the fact that nearly all of the railway companies in the country that would be likely to use the overhead trolley system are now electrically equipped, and that the third rail and underground conduit methods are being rapidly adopted for the important new enterprises, an adverse decision in this case will have but slight effect upon the business of your company.

Many other cases based upon patented inventions of great value, including a number on the overhead trolley system, are being pressed against infringers, in which early and, it is believed, favorable decisions are expected.

Departments of Sales, Manufacturing and Finance.

Your careful attention is called to the reports of the vice-presidents having these departments in charge.

Your directors desire to express their appreciation of the valuable service of your admirable engineering and commercial staff, as a result of whose ingenuity and vigilance the company has more than maintained its position of pre-eminence in the varied and constantly increasing applications of electricity.

First Vice-President Griffin's report of the sales department shows that the orders received during the year largely exceeded those of the previous year and made it necessary for the company to enter upon the present year with a larger number of unfilled orders than ever before in its history. The report contains considerable data that cannot fail to prove interesting. A condensed report of the operations of the year is presented:

Total sales (amount billed to customers)	$12,[illegible]
Cost of goods sold, general expenses and taxes, including sundry losses and allowances for losses	[illegible]
Profit on sales......	$ [illegible]

From this profit should be deducted debenture interest, etc., as shown in the report of the second vice-president.

Lighting Department.

We have received during the past year orders for [illegible] kilowatt capacity of arc and incandescent lighting machines, as against orders for the year 1896 of [illegible] kilowatt capacity, an increase of [illegible] per cent.

Railway Department.

Orders received (money value) for railway apparatus has shown an increase of [illegible] per cent over 1896.

Orders for railway generators aggregated over [illegible] kilowatts.

The average size of the railway motor has increased to [illegible] horse power, while the average railway generator for 1897 was [illegible] horse power, as against [illegible] horse power in 1896.

Power and Mining Department.

The growth of business in the class of electrical apparatus handled by this department is strikingly shown by the following comparison of orders received for the years named:

Orders for 1893 were 36 per cent. in excess of orders for 1892.
Orders for 1894 were 126 per cent. in excess of orders for 1893.
Orders for 1895 were 10 per cent. in excess of orders for 1894.
Orders for 1896 were 60 per cent. in excess of orders for 1895.
Orders for 1897 were 60 per cent. in excess of orders for 1896.

Orders for direct-current and induction motors aggregated 19,531 horse power, as against 15,171 horse power in 1896. Orders for multiphase generators aggregated 49,902 horse power, as against 25,007 horse power in 1896.

Total transmission lines installed in connection with General Electric apparatus, 326 miles, as against 232 miles in 1896.

Supply Department.

The supply department has handled 113,229 separate orders during the year, or 43 for each working hour. The orders received in 1897 exceeded by 20 per cent. the orders received in 1896.

The supply stocks carried at our local offices have been decreased about seven per cent. during the year, and of the present total 90 per cent. consists of active supplies, a great improvement over previous years.

The following are some of the principal articles handled by the supply department:

Wattmeters.—Total number ordered during the year 36,874, an increase of 42 per cent. over 1896.

Measuring Instruments.—Total number ordered during the year 3,369, an increase of 38 per cent. over 1896.

Transformers.—Total number ordered during the year 11,498, an increase of 36 per cent. over 1896.

Arc Lamps.—Total number ordered during the year 24,158, an increase of 75 per cent. over 1896.

Sockets and Receptacles.—Total number ordered during the year 2,357,629, an increase of 36 per cent. over 1896.

Foreign Department.

The orders of the foreign department have shown a gratifying increase over the orders for 1896. Several notable contracts have been placed with us by our foreign companies—the equipment of the Central London underground railway and the equipment of the street railways in several European cities.

Incandescent Lamp Sales.

The incandescent lamp orders for the year aggregated 6,857,239, of which 6,706,624 were shipped. This is an increase of about 10 per cent. over the year 1896.

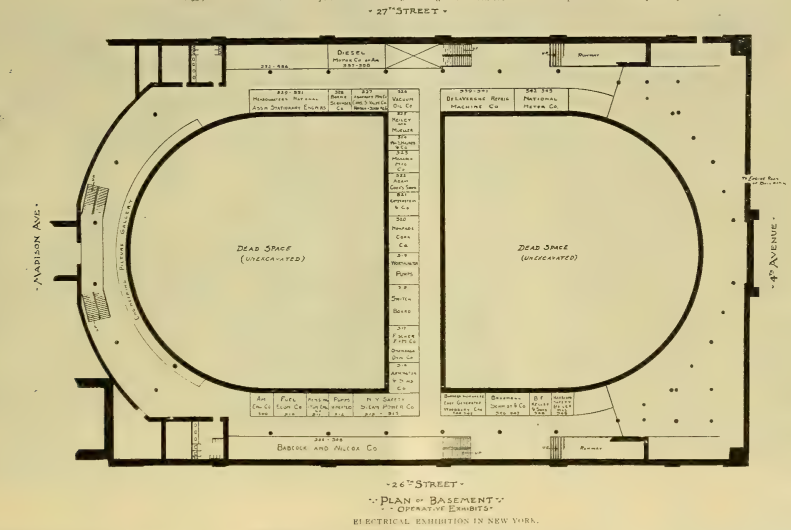
The report of the manufacturing and engineering department describes the improvements and extensions that have been made in the factories and some of the notable changes that have been introduced and methods employed. Third Vice-President Rice says:

The number of undertakings requiring machinery of large capacity and special design has increased materially during the past year. This has been due largely to the application of electricity to the operation of underground, suburban and interurban railroads, and also to the concentration of power in large units, due to the demonstrated economy of our three-phase machinery and the rotary converter mentioned in previous reports. A most notable and important installation is that of the underground Central London railway, which we are equipping with three-phase generators, rotary converters and 32 large electric locomotives.

Another remarkable undertaking is that of the mammoth new station of the Metropolitan Traction company of New York. From this station enormous electric generators will operate, through the medium of rotary-converters and other machinery of our design and manufacture, the electric street cars throughout nearly the entire borough of Manhattan.

In my last report I called attention to the value of our rotary converter, a species of connecting link between the alternating and continuous current systems which enables existing continuous current plants to add the advantage of alternating current generation and economical transmission to the simplicity and effectiveness of the continuous current distribution. The economies which thus result from the substitution of a single large alternating-current power station for a number of small stations is well illustrated in a notable installation of such apparatus made during the past year by the Brooklyn Edison company, using our three-phase generators, rotary converters, synchronous motors and other appliances.

The number of long distance transmission plants has greatly increased during the past year, so that we have now a total generating capacity in such plants of over [illegible] horse power, and



PLAN OF BASEMENT — OPERATIVE EXHIBITS.

ELECTRICAL EXHIBITION IN NEW YORK.

1 On $[illegible] for four months and on $[illegible] for eight months.

among these some 20 installations are operating at potentials of over 10,000 volts and transmitting a total of some 50,000 horse power to distances varying from 10 to 40 miles. The 5,000 horse power plant at Ogden, Utah, has been in operation for nearly a year, transmitting power to Salt Lake City, a distance of 36½ miles, at a potential of 16,000 volts. We have now under construction apparatus intended for the transmission of over 4,000 horse power from a distant water power 80 miles to the city of Los Angeles, Cal., at a pressure of 33,000 volts. The St. Anthony Falls plant, mentioned in my last report, has been completed and is now in regular operation, furnishing power to the street railways of Minneapolis and St. Paul, Minn.

In the city of New Orleans, La., we shall soon have in operation a novel plant of some 4,000 horse power, which will be used to operate pumps for the drainage of the city. Three-phase machinery will be employed.

The driving of all machinery in cotton mills and factories by electric motors is increasing rapidly, even where the original source of power is a steam engine located in or near the mill or factory itself.

The United States Navy is adopting the electric drive in place of steam or hydraulic machinery for ventilating, pumping and hoisting on shipboard and for lowering and elevating guns and for turning turrets on the warships. This is in addition to the recognized use of electricity for lighting and small power work.

We shall soon be operating our Schenectady works from a distant water power. We have contracted for a supply of 2,000 horse power from the falls of the Hudson river at Mechanicsville, 19 miles from Schenectady. A novel feature of this transmission is that the generators, each of 1,000 horse power, have been constructed by us to produce directly a pressure of 12,000 volts, thus saving the cost of the usual intermediate step-up transformers.

Second Vice-president Ord's report contains the balance sheet and statement of profit and loss, which include the assets and liabilities and profit and loss accounts of the Edison General Electric, Edison Electric Light and Thomson-Houston Electric companies (which, for convenience of bookkeeping, are consolidated with those of the General Electric company) at January 31, 1898. Following is an abstract of the report:

Patents and Franchises.

During the year there was expended for acquiring new patents and in patent litigation $333,334.68, all of which has been written off to profit and loss, leaving the patents, franchises, good will, etc., of the company standing unchanged at $8,000,000.

Factory Plants.

A summary of the changes in this account since the last annual report is as follows:

	Book Value Jan. 31, 1897.	Cost of Additions.	Written off for Depreciation.	Book Value Jan. 31, '98.
Real estate....	$1,795,000.00	$164,715.35	$102,670.70	$1,857,044.65
Machinery......	1,605,000.00	183,879.85	245,924.50	1,542,955.35
Patterns........	1.00	71,450.87	71,450.87	1 00
Sundries........	1.00	18,874.06	18,874.06	1.00
Totals.......	$3,400,002.00	$438,920.13	$438,920.13	$3,400,002.00

	Jan. 31, 1897.	Jan. 31, 1898.
Book value of Schenectady plant......	$2,157,000.90	$2,300,000.90
Book value of Lynn plant	993,000.80	900,000.80
Book value of Harrison plant.........	250,000.30	200,000.30
Totals	$3,400,002.00	$3,400,002,00

Summary of Stocks and Bonds.

	Par Value.	Book Value.
Stocks enumerated in Schedule A....	$ 8,311,331.67	$3,772,389.10
Bonds enumerated in Schedule A....	5,165,455.28	3,423,082.32
	$13,476,786.95	$7,195,471.42
Sundry stocks and bonds not included above:		
Stocks and bonds of local lighting and street-railway companies wholly owned.	$ 850,560.00	$ 196,941.77
Sundry small holdings..........	216,816.00	63,327.77
Miscellaneous stocks and bonds carried at one dollar for each lot.	44,878,615 14	132.00
Total stocks and bonds..........	$59,422,778.09	$7,455,872 96

Consolidated Balance Sheet of January 31, 1898.

ASSETS.

Patents and franchises.....			$ 8,000,000.00
Factory plants.............			3,400,002.00
Real estate (other than factory plants)..............			586,528.61
Stocks and bonds...			7,455,872.96
Cash.....................			1,425,874.93
Notes and accts. receivable		$4,537,300.88	
Work in progress..........		283,831.99	
		$4,821,132.87	
Inventories:			
Factories..............	$3 249,183.33		
General and local offices.	558,635.23		
Consignments............	52,731.79	$3,860,553.35	
			8,681,686.22
Profit and loss............			11,725,561 03
			$41,275 525.75

LIABILITIES.

Capital stock:		
Common..............................	$ 30,460,000.00	
Preferred	4,252,000.00	
		$34,712,000.00
Five per cent. gold coupon debentures		6 000 000.00
Accrued interest on debentures....	50,000 00	
Accounts payable......................	263,525.75	
		313,525.75
Reserve for extensions to factory plants..............................		250.000 00
		$41,275.525 75

Consolidated Profit and Loss Account of January 31, 1898.

EXPENSES.

Balance January 31, 1897		$12,957,41[illegible]
Cost of goods sold	$9,241,821.54	
General expenses, taxes, sundry losses, and allowances for losses...	1,654,756.60	
		10,896,578.14
Interest on debentures		333,333.35
Patents and patent expenses...		333,331.68
Reserve for extensions to factory plants..............		250,000.00
		$24,770,659 57

EARNINGS.

Sales....	$12,396,093.49	
Royalties and sundry profits......	128,844.58	
		$12,524,938.07
Dividends and interest received on stocks and bonds owned	299,417.91	
Interest and discount .. .	90,371.25	
		389,789.16
Profit on sales of stocks and bonds	116,355.94	
Discount on debentures purchased and canceled.	14,015.37	
		130,371.31
Balance January 31, 1898.. . . .		11,725,561.30
		$24,770,659 57

Grinding Wheels for Street-railway Service.

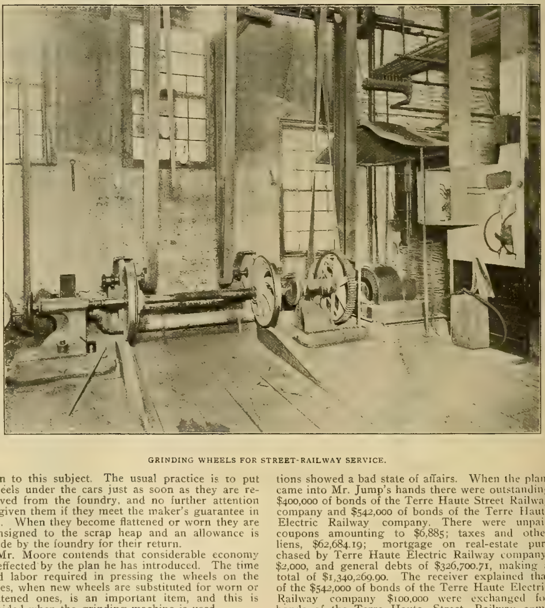
There is considerable difference of opinion between street-railway men and makers of car wheels as to the economy of grinding car wheels, so much so indeed that it seems as if each particular case would have to be decided for itself.

During the last few years the Chicago City Railway company has collected considerable data on the South Side system, and the conclusion reached by the master mechanic, E. C. Moore, is that the life of a car-wheel is increased and the efficiency of the service is promoted by grinding wheels before they are put under the cars as well as after they have become worn. Last year the company used 3,143 wheels, and the average term of service was 14 months. All of these wheels when received were pressed upon axles, sent to the grinding room and then put under trucks as required. They are continued in service until they become worn or flattened and then returned to the shop, where they are put through the grinding process and once more put under the cars. In particularly trying service this operation may be repeated several times in the course of a year with one pair of wheels, but in many cases little attention is required after the wheels are first put under the car after having been polished up on the grinding stone. Mr. Moore claims that the wheels run much more smoothly after the grinding process.

Probably a majority of the street-railway companies of the country have never given any attention to this subject. The usual practice is to put wheels under the cars just as soon as they are received from the foundry, and no further attention is given them if they meet the maker's guarantee in life. When they become flattened or worn they are consigned to the scrap heap and an allowance is made by the foundry for their return.

Mr. Moore contends that considerable economy is effected by the plan he has introduced. The time and labor required in pressing the wheels on the axles, when new wheels are substituted for worn or flattened ones, is an important item, and this is avoided when the grinding machine is used.

The accompanying picture gives an excellent idea of the arrangement, as it shows a pair of wheels undergoing the process. The grinder was made by the Plamondon company, and its capacity is said to be one set of wheels per hour. The grinder is driven by a 15 horse power motor wound for 500 volts and making 875 revolutions per minute. The motor was made by the Card Electric company of Mansfield, Ohio.



GRINDING WHEELS FOR STREET-RAILWAY SERVICE.

National Electric Light Association.

President Insull of the National Electric Light association returned to Chicago on Wednesday from New York, where he attended the opening exercises at the electrical exhibition. He says that the eastern delegation to the convention will be large and thoroughly representative. Much interest is already shown in the plans.

Among the special features for which arrangements have already been made is a discussion of the subject of "Municipal Ownership," which will be opened by Alex Dow of Detroit. The question of distribution methods will be handled by Herbert A. Wagner of St. Louis and Louis A. Ferguson of Chicago. The consideration of methods of charging will probably be one of the most interesting features of the meeting. The arrangements for this discussion have not yet been completed.

President Insull announces that a meeting of local representatives of the electrical interests will be called at once to arrange the details of the convention.

Affairs of the Terre Haute Electric Railway Company.

A meeting of the creditors of the Terre Haute (Ind.) Electric Railway company, which has been in the hands of Receiver Joshua Jump since the middle of last October, was held at the Terre Haute House on Tuesday of last week. The creditors represented included several banks and other bondholders and a number of concerns to which the Terre Haute company is indebted. Among the latter are the Terre Haute Car Manufacturing company, the Commercial Electric Supply company, the Diamond Electric company, John A. Roebling's Sons company, Illinois Steel company, Western Electric company, Stanley Electric Manufacturing company, Sunbeam Incandescent Lamp company, American Electric Heating corporation and the Hunter Fan and Motor company. The chairman selected was E. O. Brown of the First National Bank of Chicago, and J. B. Wallace of the Chicago office of the Stanley company was made secretary of the meeting.

The receiver's statement and his answers to questions showed a bad state of affairs. When the plant came into Mr. Jump's hands there were outstanding $400,000 of bonds of the Terre Haute Street Railway company and $542,000 of bonds of the Terre Haute Electric Railway company. There were unpaid coupons amounting to $6,885; taxes and other liens, $62,684.19; mortgage on real-estate purchased by Terre Haute Electric Railway company, $2,000, and general debts of $326,700.71, making a total of $1,340,269.90. The receiver explained that of the $542,000 of bonds of the Terre Haute Electric Railway company $100,000 were exchanged for bonds of the Terre Haute Street Railway company, $190,000 had been sold and $252,000 were held as collateral security, he understood, for $160,000 of debts. In response to inquiries the receiver stated that the books of the company did not show what the $190,000 of bonds sold for, who they were sold to, or what disposition had been made of the proceeds. The books, he said, did not show what part of the $252,000 of bonds used by the late management as collateral security was so used for merchandise account, and what part had been used for collateral for notes, or what notes had been issued, what the proceeds of notes were, what commissions or interest had been paid upon notes, or what disposition had been made of the proceeds of the notes. The company maintained a New York office, apparently in charge of Mr. Hoyt, through which the bonds and notes were marketed. The receiver found that all the assets of the company in New York when he took charge was a bank balance of $48.74. His statement does not show any cash assets in Terre Haute. From October 18, 1897, to April 1, 1898, Mr. Jump received $63,445.31 and disbursed $63,325.52. The receiver also reported that the condition of the

boilers, when the property came into his hands, was such that the plant practically collapsed, and under order of the court he issued $25,000 of receiver's certificates for putting in the boilers. In this special fund there was a balance sufficient to complete the erection of the new boilers.

In general the receiver had found things in a bad way—wages were in arrears; current taxes were past due; the plant had depreciated and business had been lost through inefficiency; holders of the real-estate mortgage threatened foreclosure unless the interest was paid; supplies had been conditionally purchased and would be removed unless the balance of the purchase money was paid, and so on. As a result of ambitious financing the affairs of the company appear to be badly involved.

After the situation had been discussed by the creditors, a committee was appointed to thoroughly acquaint itself with the company's affairs and devise a plan of reorganization or adjustment. This committee consists of Mr. Brown, Mr. Deming and Mr. Hussey, representing the banks; Mr. Carpenter and Mr. Wallace of the Western Electric and Stanley companies respectively, and Messrs. Kidder and Singer of the Illinois Steel company. An officer of the city government of Terre Haute will be a member of the committee ex-officio. This committee is now in charge of the creditors' interests, and the meeting adjourned subject to its call.

Before adjournment, however, the attendance of Russell B. Harrison, the president of the Terre Haute Electric Railway company, was requested and obtained. Mr Harrison stated that he could not tell at what time or at what price the $150,000 bonds of the company were sold, or what they netted the company or what disposition had been made of the proceeds. He could not tell what notes had been issued with bond collateral, what money had been realized upon these notes, what commission had been paid, or what disposition had been made of the proceeds. He would be able to ascertain this, he said, from his correspondence with Mr. Hoyt, and by getting additional information from Mr Hoyt. He explained that he was just about to accompany the militia company to Indianapolis on call of the governor, and that it would be impossible for him to state when he could give this information. He could not explain the increase in the indebtedness, what it represented, or what had been realized from the sale of the company's notes and securities without looking the matter up. He said that as soon as possible he would take the matter up with the committee, but he could not fix a date when he would be able to do it. Mr Harrison stated that he had possession of the stock book and would surrender it to the receiver. All but a few shares had been issued to him and were held by Mr. Thomas, he said, as security for the carrying out of the agreements he had made with Messrs. Kidder, Rippetoe and Thomas when he purchased the Terre Haute Street Railway company. Mr. Harrison was in a hurry, and, apparently not being able to give any information, was excused.

Electrical Fires.

The last quarterly report of the electrical bureau of the National Board of Fire Underwriters contains several interesting accounts of fires due to electricity. William H. Merrill, Jr., electrician of the board, commenting on the reports, says: "Additional reports are received of losses aggregating $700,000, all of which are supposed to be due to electricity, and in many of the accounts apparently very good circumstantial evidence is given, but they are omitted from this report because in many of the cases the fires burned up all evidence of their origin and in others the presumption is made that because electric wires were found near the point where the fire started and no other possible cause was discovered 'the wires' in some manner not specified caused the fires. A large number of casualties resulting in deaths and more or less serious injuries to persons are reported, and accounts are received of several instances where the presence of trolley and other wires in the street seriously interfered with the work of firemen."

Three "characteristic burn-outs" are illustrated in the report and through the courtesy of Mr. Merrill are herewith reproduced, with the accompanying explanation:

Fig. 1 is a reproduction of a photograph from F. R. Whitney, superintendent of fire alarms at Lewiston, Maine, and in the official report is numbered 2,164, the explanation being as follows: "Cross between arc-light and telephone circuits caused the telephone line to ground where it entered the office of a large grist-mill. The wire laid on a cross timber over the office and the arc formed by the ground ignited the thick dust on the timber and spread the fire rapidly. The mill was burned to the ground. Loss, $20,000."

The photograph from which Fig. 2 was made was furnished by Mr. Whitney also, and the cause of the accident illustrated is explained in paragraph 2,167, as follows: "A guy wire to a telephone pole was fastened to a three-story brick building and touched an eave-trough and drain which extended nearly to the ground, also being in contact with the suspension wire of a telephone cable on the pole. Workmen half a mile away, while putting up a derrick, allowed a wire rope to fall across the telephone cable and a trolley wire. The trolley current found no ground until it reached this building. At this point an arc formed between the guy wire and the eave-trough which set fire to the surrounding wood work. Fire was soon discovered and extinguished with small loss."

In Fig. 3 burned-out fire-alarm boxes are shown. Charles F. Hopewell, superintendent of firm alarms at Cambridge, Mass., who furnished the photograph, reports the cause to have been a cross between the fire-alarm and trolley wires. This is fire number 2,259 in the report and is thus officially recorded: "Cross between fire-alarm and trolley wire allowed the heavy trolley current to enter fire-alarm boxes located on switchboard. The shunt of the door of the boxes was small and of insufficient capacity. The loss to boxes amounted to $900, besides crippling the service until after a severe storm."

Fig. 1

Fig. 2

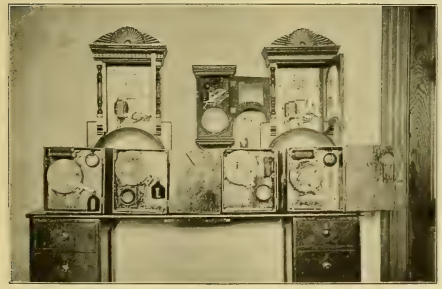


Fig. 3

ELECTRICAL FIRES.

American Institute of Electrical Engineers.

The 124th meeting of the Institute was held at New York, Wednesday evening, April 27th, when a paper on "An Economy Test of Central Stations" was presented by Prof. W. E. Goldsborough of Lafayette, Ind.; also a paper on "A Novel Form of Thermo-electric Battery," by C. J. Reed of Philadelphia, which was accompanied by experiments. The discussion was participated in by Messrs. Cox, E. P. Thompson, Mailloux, Reed, Wintringham, Steinmetz and W. M. Mordey of London.

At a meeting of the executive committee in the afternoon the following-named associate members were elected: Wyatt H. Allen, San Francisco, Cal.; William H. Fitchugh, Bay City, Mich.; John Breckenridge Fleming, Austin, Nev.; George J. Henry, Jr., New York.; N. S. Hopkins, Schenectady, N. Y.; Robert Lindsay, Cleveland, O.; Frederick A. Muschenheim, New York; Newton L. Schloss, New York; Clarence M. Tappan, Silverton, Colo.; Ernest Stiles Vinten, New Haven, Conn.

There promises to be some difficulty between the electric-lighting company and the city of Stevens Point, Wis. The plant was assessed under the old law instead of the law of 1897, which taxes the gross earnings. The tax has not been paid and the property was returned as delinquent. A certificate issued on the property will be illegal. On the other hand, the company is liable to a fine for not returning a sworn statement of gross earnings.

Western Electrician.

EVERY SATURDAY.

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CORRESPONDENCE relating to electrical or any of its practical applications is cordially invited, and the cooperation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—the only general electrical paper published in the West—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 20,000.

Four Years' Record of Electric Light Convention Advertising.

Issue	Number of Advertising Pages.	Whole Number of Pages.	Square Inches of Paid Advertising Matter.
March 3, 1894	40	56	4,145
February 23, 1895	52	68	5,593
May 9, 1896	72	88	7,376
June 12, 1897	80	100	8,643

No other electrical journal has ever equaled this record of 8,643 square inches of genuine full-paid advertising in a single issue.

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The New York office of the Western Electrician has been removed to 809 Postal Telegraph building. The new location is admirably adapted to the business, and the facilities offered are superior in every way to those formerly enjoyed.

It will be of interest to manufacturers and users of electrical measuring instruments to know that on April 24th the English patent No. 6,770, granted to Dr. Hermann Aron in 1884 for "Improved Means for Measuring Electric Currents," expired. The London Electrician says that this patent covered the original form of the Aron meter, which is said to have been practically a modification of the historical "ergmeter" of Profs. Ayrton and Perry. The patent also claims the application of the same electro-magnetic-control principle to clocks "regulated by a vibrating spring." Since the date of the patent several improvements have been introduced in the instruments, the latest type being self-winding and automatically compensating for inaccuracy in the regulations of the clockwork itself.

More public interest has been aroused in the cable system of the world by the war with Spain than has ever before been manifested. Few people had any idea of the extent to which these enterprises had been developed. They had grown accustomed to reading reports of events in the East, the West, the North and the South, but they did not realize the efforts that were required to gather and transmit this intelligence, nor the part that the great telegraph companies played in it. Now, however, when cable communication with Havana and Manila is interrupted and the daily recital of events in these important centers must be discontinued temporarily at least, the reading public begins to understand how much the world depends upon the modern telegraph and what an important part it plays in the everyday affairs of the human family.

President Lang of the American Street Railway association is a practical street-railway manager and a man of affairs. He takes a common-sense view of the relations between quasi-public corporations and municipalities, and in an address delivered before the students at Purdue University, which is presented in detail on another page, Mr. Lang says: "I do not believe that municipal ownership of such properties is wise in any sense, nor that much will be done in this direction, especially not if private corporations keep pace with the best methods of service and offer reasonable rates. I am one who believes that the community will deal with these corporations fairly if the corporations will be equally fair with the community." There can be no doubt that corporations which give good service at reasonable rates will have nothing to fear from the politicians who are howling for municipal ownership in order to secure additional patronage. It is only when corporations do not deal fairly with the people and the municipality that the demand for city plants receive the support of others than professional politicians.

The Topeka, which was purchased for the United States at London on April 2d, arrived safely in New York on May 1st and was at once put in active service. It is announced that the new cruiser was secured in a hurried manner, and that the negotiations for her purchase were carried on over the telephone. After the bargain had been verbally concluded Lieut. Colwell, the naval attaché of the American embassy, left his office and went to the Thames Iron Works, where the ship was purchased, and took possession in the name of the United States. The new acquisition to the American navy was built in Germany in 1884, at the time of the Chilian-Peruvian war. She was a sister ship to the Lima of the Peruvian navy, and was named the Diogenes, but was never delivered to Peru. The Diogenes was reconstructed in 1896 at the Thames Iron Works in England. Her displacement is 1,800 tons. Her load water line length is 250 feet and her beam 35 feet. She was built for an armament of six 4.7-inch rapid-fire guns, 10 six-pounders and six three-pounders. The 4.7-inch guns will be mounted, two on the forecastle and one in each of four broadside sponsons. The Topeka is brig-rigged and has no military tops. She has the distinction of being the only vessel of the kind ever purchased by telephone.

Inventors, manufacturers and patent attorneys have been clamoring for improvements in the Patent Office for several years, and while the department has been more than self-sustaining it has never been given the consideration which it deserves. Now, however, it is in a fair way to reap some of the fruits of persistent agitation, as the Platt bill for revising and perfecting the classification of letters patent and printed publications in the Patent Office has passed the Senate and is now pending in the House, with an excellent chance of soon being enacted into a law. The bill carries with it an appropriation to provide for three additional principal examiners, two first-assistant examiners, two second-assistant examiners, six third-assistant examiners and five fourth-assistant examiners. With this increase in the working force, the records of the office, now greatly in arrears, can be brought up to date and kept reasonably close.

The telegraph and the telephone are recognized as invaluable agents of civilization, but the part they play in developing unsettled countries is not generally appreciated. The report of the British South Africa company calls attention to these facts, the circumstance being mentioned that the telegraph precedes the road-making and keeps the outlying districts in touch with the headquarters of the company. In the event of a rising of the natives, the wires may be cut and communication interrupted, but the interruption gives the signal that trouble has occurred in a certain district. The total mileage of public roads maintained by the company is 2,230, and extensions are being made along the telegraph routes. The company's telegraph system was increased by 126 miles in 1896 and by 200 miles in 1897. On September 30, 1897, 1,856 miles of line and 2,583 miles of wire had been erected. The total amount expended by the company on telegraph construction up to March 31, 1897, was £139,677, and the net profit for the financial year ended on that date, after deduction of cost of maintenance, was £13,391. The telephone service is being extended gradually. There are now 182 miles of telephone lines connecting the forts, and several exchanges are being fitted up. The work now in progress ensures a comprehensive telephone system for the district within a comparatively short time.

According to report in the German technical press the electric motors on the new German warship Aegir were only fairly successful in practice during the recent tests. The account at hand does not state the type of machines used, and no reason is given for the noise of the motors, which is a cause of complaint. It is said that this electrical plant is the first of its kind to be established on a large scale in the German navy. Electric motors are used to drive 10 ventilators, and 14 other motors serve for manipulating the guns and rudder, for the ammunition hoists and for other purposes. The convenience of the electric motor for power on shipboard is acknowledged, but it seems that the generating plant had been designed on the assumption that not all motors would be working simultaneously. For lowering the lifeboats and keeping the searchlights going at the same time, there was not sufficient current to be had. The noise of the electric motors within the turrets is said to have been very disagreeable, and for the steering machinery steam seemed preferable. To put the rudder through 35 degrees required 28.7 seconds, and the first five degrees demanded five seconds' time; this was deemed unsatisfactory. The electric steering plant, moreover, was reported to be heavier than the ordinary steering engines. Raising the anchors proved almost too great a strain on the electric motors. Pneumatic ammunition lifts also appear more practical, it is said. It should be stated that the compass was very carefully watched during these tests of the electrical installation and that no disturbances were observed.

On American war vessels the electrical apparatus has worked with a very encouraging degree of success, and, as reported in another place, the electric ammunition hoists and turret-turning gear on the New York was perfectly reliable and efficient during the brief test of service in the bombardment of the fortifications of Matanzas last week.

WAR OPINIONS.

In answer to inquiries addressed to representative electrical men by the Western Electrician, asking for opinions on the probable effect of the war on the electrical industries, the following responses have thus far been received. It is fair to say that these letters were written before the news of the great victory of Manila Bay was received and that the pessimistic ones do not reflect the views of the Western Electrician.

Elisha Gray, Highland Park, Ill.: I do not believe that the electrical or other interests will be seriously affected by the war. There may be a temporary depression for a month or two in some lines of business. There will be, immediately, 125,000 more men employed by the government. Their places will have to be filled, and fortunately there are men ready to fill these places. War will increase the demand for many things. Wages will be higher and more men will be employed. When everybody is employed at good wages, and when there is a good home and foreign demand for our products, both agricultural and manufactured, we cannot help having good times. Whenever the government is a large buyer, as it always is in time of war, money is always scattered and it gets into the hands of a class of people who spend it. This was true during the war of the Rebellion, as all who are now past middle life well remember. I do not believe there will be any shock in electrical industries. I should rather expect that they would be stimulated.

C. C. Warren, Warren Electric Manufacturing company, Sandusky, O.: In my opinion the effect on the electrical industries of the present regrettable but wholly unjustifiable war will be varied in character. Certain localities and specialties will be benefited, since there will be phenomenal demand for electrical devices and appliances called for by the development of modern warfare. Modernized war means the utilization of every known force which may best be employed to aid destruction—that which will cause the most unspeakable human torture and create the most frightful havoc—this being warranted by the theory that the more appalling war becomes, and the more destructive and horrible the result, the sooner it will be ended, and in the main will entail less human misery. Electricity in its various departments will become a tremendous factor in the present war in ways innumerable, and our government must surely call for an immense amount of appliances. Industries supplying the demands of the government will also utilize electricity to a great extent, and electrical industries in certain localities will reap benefits. The war will doubtless check the development of interior railway schemes, retard intended extensive lighting and electric power projects, and will cause capitalists (the class always first frightened) to hesitate about investing, they preferring to continue the hoarding process until the war is over, thereby delaying what promised to be an active period of electrical development. I believe the war will delay and disturb more than it will benefit. Enterprises requiring the assistance of the timid capital will suffer, and that requiring capitalistic aid is, in my opinion, of greater magnitude than government requirements; therefore I cannot believe that war will inure to the advantage of the electrical industries of this country, taken as a whole.

E. J. Nally, Postal Telegraph-cable company, Chicago: It is hard at this time to state what the probable effect of the war will be on the electrical industries of this country, that is, so far as the telegraph is concerned. The telegraph business is a barometer of general business, and while it may fall off in certain directions, it is likely to increase in others, according to the way in which one branch of trade may be killed and the other stimulated by war. For example, the Postal is doing a very heavy press or newspaper business at this time, and our brokerage business is good at all points. The demand for press reports from all parts of the country is unprecedented. Newspapers in small towns heretofore content to use "plate" or "patent inside" are calling for a daily report by wire. Newspaper "special" business is also very heavy. In fact, at the present writing, everything seems to have an upward tendency, and the telegraph business is always good when there is a rise in prices and correspondingly poor when there is a decline.

B. E. Sunny, General Electric company, Chicago: The effect of the war on the electrical business will depend altogether on the money market. For eight months the money market has been very easy, and money has been abundant at low rates. Anyone with good credit standing could have what he needed on proper security of course, for additions and improvements or for new enterprises, so that there has been a very marked movement in the business of the electrical companies since the fall—indeed, it has been larger than at any time since 1893. With the declaration of war, work on all new enterprises of magnitude—except where the money is in bank to complete them—will stop, for the reason that no careful banker or capitalist will go into anything involving the expenditure of cash in the face of a long war that may call for the money of the nation and its citizens to protect what we already have. The situation to-day means that the banks will soon cease loaning, except for the legitimate wants of their regular customers and at higher rates; that new enterprises will be put aside and improvements and additions postponed, with the result that we shall have a repetition of the business depression from which we recently thought that we had just escaped. Of course the war may be very short, as we all hope it will be, in which case the American people will furnish another example of the alacrity with which they can transfer their attention from one subject to another.

George A. McKinlock, Central Electric company, Chicago: I think the electrical industries, owing to their close association with our railways, will be affected indirectly more than directly. The first effects that are noticed are the large government orders, which have been placed with the wire and manufacturing companies, taxing their capacity to supply immediate requirements, and affording an opportunity for the various electrical devices, which have been looked upon largely of an experimental character, to test their value for war uses. Indirectly, if the war is to be protracted, which I do not regard as likely, and the Spaniards are able to get within gun-shot of our coasts and maintain any sort of a position there, we naturally will feel the influence of a menace of this character in a drawing-in of capital and the unsettling of markets and our commercial enterprises, and in the event of our being defeated in an important naval engagement business interests will feel a shock that will be disastrous. Happily we have little to fear of the outcome of any contest with the Spanish forces on the sea, and if it were not for the daily papers, we would, in my judgment, not be aware that war exists, in so far as our business is concerned.

A. O. Fox, Northern Electrical Manufacturing company, Madison, Wis.: It is in my belief that the war will be short and decisive. Should it terminate promptly and in our favor, as I think it will, the effect will be to advance American securities, popularize America and things American. If this assumption is correct the final result would probably be some thing of a stimulus to manufacturing and an appreciation in prices accordingly.

J. W. Lieb, Jr., Edison Electric Illuminating company of New York: Thus far the war has had no sensible effect on the business of this company, which is confined to the generation and distribution of current on Manhattan Island, but the experience of an exclusively local company would hardly form a proper basis on which to gauge the probable effect on the electrical industries of the country in general.

A. Stromberg, Stromberg-Carlson Telephone Manufacturing company, Chicago: While the war may slightly delay some of the larger proposed work, we do not anticipate it will materially change any of the plans contemplated in the independent telephone business. We rather believe it will have a tendency to more rapidly increase the work in and between the smaller towns. We are pleased to say that it has not affected our business adversely.

J. W. Marsh, Standard Underground Cable company, Pittsburg: I do not believe that the war will affect adversely any existing electrical industries, but it will probably check new enterprises for a little while, if not until the war is over. Judging by our own business, neither "rumors of war" nor the war itself have been able to cause a diminution of commercial orders, while naturally the government orders for our goods have been very large and are likely to continue for some months. I do not believe that export business will be much injured in view of the small percentage of goods exported in American bottoms.

H. M. Atkinson, Georgia Electric Light company, Atlanta, Ga.: To answer this question correctly merely means to forecast the history of the war, and I must confess my inability to do this. The war may drag along without anything decisive done on

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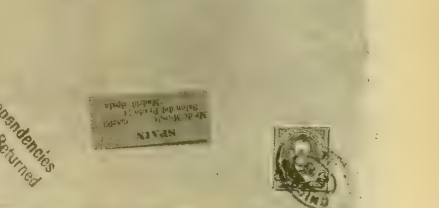
WAR NEWS.

No Mail Communication with Spain.—The postmaster-general has issued an order directing that all mail matter deposited in the postoffices of this country for transmission to Spain be returned to the senders or sent to the Dead-letter Office at Washington. This is, of course, a war measure, pure and simple, and something new to this generation of Americans. One result is to shut the Western Electrician, with other American periodicals, out of Spain. Readers of this journal will be interested in the photographic reproduction, slightly reduced, of a portion of the wrapper on a copy of last week's Western Electrician mailed to a Spanish subscriber in due course, but returned to this office by the postoffice authorities, with the reason plainly stamped thereon. Señor de Muralt will miss his paper, but doubtless he can obtain back numbers when the war is over.

Norman Harrington's Bravery.—Herbert W. Bowen, late United States consul-general at Barcelona, who is a passenger on the Cunard liner Etruria, now en route from Liverpool to New York, is credited with the following interesting story:

"During the morning of April 20th a mob of 3,000 or 4,000 people suddenly filled the square in front of the consulate, cheering for Spain and uttering other cries. I was breakfasting at the hotel on the opposite side of the square. This mob had come determined to get the consul, the eagle and shield. I managed to push my way through the people until I got my back to the consulate and faced the mob. There I awaited the result. I had hardly taken up my position when I noticed a man as big as myself (Mr. Bowen is about six feet high) pushing through the crowd. He came and stood beside me, did not speak, but faced the crowd, which continued to threaten us. Fortunately the mob had no leader, so, for a quarter of an hour, we two and the mob faced each other. Then the police and soldiers arrived and the mob melted away. I asked the stranger who he was and he replied: 'I am Norman Harrington of Chicago. This is my first day in Barcelona. It seemed to me as if there would be some trouble for the eagle up there, and I thought I'd take a bit of it.'"



NO MAIL COMMUNICATION WITH SPAIN.—WRAPPER OF RETURNED PAPER.

To electrical men an interesting feature of this story is the fact that Mr. Harrington is connected with electric-railway work. It is well known that the street-railway system of Barcelona is being equipped for electrical operation. The contractors are Dick, Kerr & Co. of London, but the sub-contract for the power-house generators and electrical station equipment was secured by the General Electric company of this country, while that for the engines went to another American concern, the E. P. Allis company of Milwaukee. Mr. Harrington, it seems, is one of the erecting engineers of the latter company. A Milwaukee dispatch to the Chicago Tribune states that he has been in the employment of the Allis company for about three years, but has been seldom in Milwaukee and but little is known of him by the company except that he is one of the most capable men in his line in the country. Mr. William W. Allis said that he could not recall Mr. Harrington, but supposed he had seen him at some time at the plant. He said: "I know that he has been in our employment about three years and is a well-educated and competent man. We have a contract with an English firm that is building electric railways in Trieste, Madrid, Barcelona and Valencia, and Mr. Harrington was sent to superintend the erection of all these plants. When the trouble with Spain broke out I remember there was a letter received from his mother, who was anxious about his safety. We immediately cabled the English firm to protect him, and we have received a reply to the effect that he will be fully protected. Although he is an American, he is working for an English firm and will not be molested. He will stay in Spain until the work is completed. I should judge from the dispatches that he is a good man outside of his

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DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Equipment of the Stewart Building, Chicago.

The Stewart building, at the corner of Washington and State streets, Chicago, is considered to be one of the largest and finest office buildings in the West, and, as might be expected, it has a complete and convenient telephone system especially adapted for such buildings. Besides having in the building a large number of public telephones for use in connection with the city exchange, it has a private plant with a telephone in every office.

The private system was installed by the Stromberg-Carlson Telephone Manufacturing company of Chicago nearly a year ago, and was one of the company's first central-ringing and central-talking battery systems. In the office of W. A. Merigold, agent for the building, there are several desk telephones. These are the regular long-distance portable desk instruments, with a small push button in their base for calling central. Fig. 1 is the wall set used in the private system, consisting of the receiver, transmitter and switch of the regular type, mounted on a highly finished, solid mahogany backboard, with a push-button at the lower end and a round nickel-

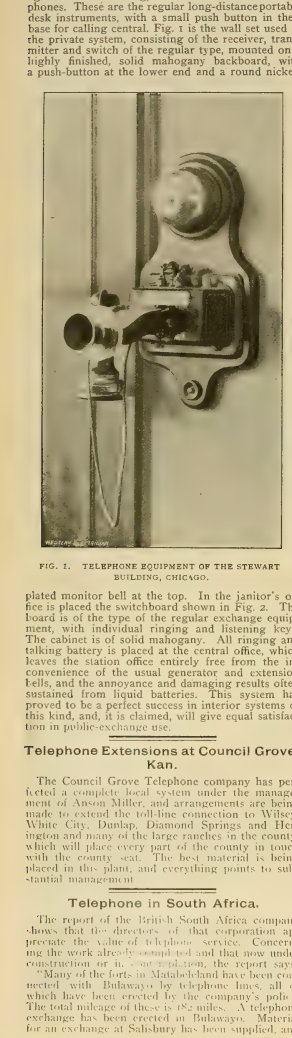


FIG. 1. TELEPHONE EQUIPMENT OF THE STEWART BUILDING, CHICAGO.

plated monitor bell at the top. In the janitor's office is placed the switchboard shown in Fig. 2. The board is of the type of the regular exchange equipment, with individual ringing and listening keys. The cabinet is of solid mahogany. All ringing and talking battery is placed at the central office, which leaves the station office entirely free from the inconvenience of the usual generator and extension bells, and the annoyance and damaging results often sustained from liquid batteries. This system has proved to be a perfect success in interior systems of this kind, and, it is claimed, will give equal satisfaction in public-exchange use.

Telephone Extensions at Council Grove, Kan.

The Council Grove Telephone company has perfected a complete local system under the management of Anson Miller, and arrangements are being made to extend the toll-line connection to Wilsey, White City, Dunlap, Diamond Springs and Herington and many of the large ranches in the county, which will place every part of the county in touch with the county seat. The best material is being placed in this plant, and everything points to substantial management.

Telephone in South Africa.

The report of the British South Africa company shows that the directors of that corporation appreciate the value of telephone service. Concerning the work already completed and that now under construction or in contemplation, the report says:

"Many of the forts in Matabeleland have been connected with Bulawayo by telephone lines, all of which have been erected by the company's police. The total mileage of these is 182 miles. A telephone exchange has been erected in Bulawayo. Material for an exchange at Salisbury has been supplied, and an order for material for an exchange at Umtali is being executed. The section of the African transcontinental line between Salisbury and Tete was destroyed during the native disturbances, and has been replaced by a section from Umtali to Tete, which follows a more healthy route, and is now completed. A portion of the old section has been restored as far as Mazoe. Considerable progress is being made with the line through the British Central Africa Protectorate toward Tanganyika, which has been completed to Kota Kota—a distance of 263 miles north of Blantyre and 595 miles north of Umtali—and is being rapidly pushed forward. The section already finished has been of the utmost service to the administration and to the imperial representatives in the British Central Africa Protectorate."

War Tax on Long-distance Telephone Business.

[Special correspondence of the Western Electrician.]

Washington, D. C., May 2.—The measure providing for war finances has been reported from the committee of the whole house with several amendments, among them the following:

"That any person, firm or corporation owning or operating what is commonly known as long-distance telephone line or lines, or other toll telephone lines, whether such line or lines, or any part thereof, is or are operated separately or in connection with the similar lines of any other person, firm or corporation, shall, on the first day of each month, return under oath to the collector of internal revenue in and for the district in which such person, firm or corporation resides, the number of messages transmitted over the respective connected or separate lines during the preceding month; the returns shall include the paid messages so transmitted from individual or other subscribers to the telephone service of the person, firm or corporation, and from the respective public pay stations of the person, firm or corporation, together with the amount received for each such message so transmitted. Upon the failure of any person, firm or corporation to make such returns, or for the making of false returns, it shall, upon conviction thereof, be fined not exceeding $500.

"On each message so transmitted, where the charge for which, according to such sworn returns, does not exceed 25 cents, the person, firm or corporation shall pay a tax of one cent; when the charge exceeds 25 cents and does not exceed $1.50, two cents; when the charge exceeds $1.50 and does not exceed $5, 10 cents.

"The taxes hereby imposed upon telephone messages shall be assessed by the commissioner of internal revenue, and the provisions of existing law relative to the assessment of taxes and of the 50 per centum penalty for neglect or failure to make returns and of the 100 per centum penalty for the making of false returns and of the collection of such taxes and assessed penalties are hereby made to apply to the taxes imposed by this section."

It is provided in this substitute bill that official government messages shall be exempted from all of these provisions.

Output of Bell Instruments.

[From the Boston correspondent of the Western Electrician.]

For the month ended April 20th the American Bell Telephone company put out the largest number of instruments in its history. The returns were heavy, however, so that the net output was a trifle more than one-half the gross output. The following is the record for the last month and also for the last nine months:

	1897-8	1896 7	1895-6.
Month April 20—			
Shipments	29,254	20,426	21,523
Returned	13,139	7,245	6,330
Net output	16,125	13,181	15,195
Since December 20—			
Shipments	109,921	73,735	76,518
Returned	51,697	28,156	28,462
Net output	58,224	45,579	48,056
Instruments in use	927,345	818,206	723,032

The Bell company has by close estimate 6,882 shareholders, holding an average of 38 shares and a fraction each. Theodore N. Vail has 4,784 shares in his name, and Lieut.-Governor W. Murray Crane 4,122 shares, these being the largest shareholders of record. The directors hold 4,304 shares between them, which is less than Mr. Vail's holding.

Telephones Cheap in Venezuela.

[From the New York World.]

The Merchants' association of this city held its last meeting of the present series of merchants' conventions recently. Charles R. Ruckland delivered an address, telling the great opportunities presented for the trade of the United States by the Venezuelan market. Said Mr. Ruckland in the course of his address:

"There are some things that Venezuela can teach the United States. One is how to run a telephone service profitably on a charge of $3.60 per month, with an additional tariff of only 10 cents for each long-distance message. And an excellent service it is too.

"The telephone is in every home in Caracas. Noticing the absence of ladies on the business streets, I was told they had no occasion to go shopping, as they sent their orders by telephone, and in the same way they ring up their friends to discuss the news of the day and society events."

Increasing Use of Telephone Service.

The New York correspondent of the Chicago Evening Post says: "If anything were needed to demonstrate further the value of the telephones—long and short-distance wires—it would be supplied by the use now being made of the system by the federal and state governments, as well as by the news-gathering organizations and the great newspapers in connection with war intelligence. To a large extent the telephone is taking precedence of the telegraph, and the revenues of the companies are increasing by leaps and bounds. But the companies themselves show no disposition to lower the charges for telephone service. Everywhere the attempt of the public to get a reduction by request or special legislation is stubbornly resisted."

The writer also calls attention to the fact that the recent meeting of the Bell Telephone company in Boston developed the fact that the output of telephones and the increase in the number of ex-

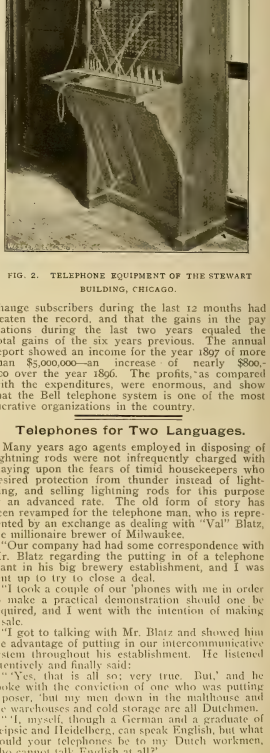


FIG. 2. TELEPHONE EQUIPMENT OF THE STEWART BUILDING, CHICAGO.

change subscribers during the last 12 months had beaten the record, and that the gains in the pay stations during the last two years equaled the total gains of the six years previous. The annual report showed an income for the year 1897 of more than $8,000,000—an increase of nearly $800,000 over the year 1896. The profits, as compared with the expenditures, were enormous, and show that the Bell telephone system is one of the most lucrative organizations in the country.

Telephones for Two Languages.

Many years ago agents employed in disposing of lightning rods were not infrequently charged with playing upon the fears of timid housekeepers who desired protection from thunder instead of lightning, and selling lightning rods for this purpose at an advanced rate. The old form of story has been revamped for the telephone man, who is represented by an exchange as dealing with "Val" Blatz, the millionaire brewer of Milwaukee.

"Our company had had some correspondence with Mr. Blatz regarding the putting in of a telephone plant in his big brewery establishment, and I was sent up to try to close a deal.

"I took a couple of our 'phones with me in order to make a practical demonstration should one be required, and I went with the intention of making a sale.

"I got to talking with Mr. Blatz and showed him the advantage of putting in our intercommunicative system throughout his establishment. He listened attentively and finally said:

"'Yes, that is all so; very true. But,' and he spoke with the conviction of one who was putting a poser, 'but my men down in the malthouse and the warehouses and cold storage are all Dutchmen.

"'I, myself, though a German and a graduate of Leipsic and Heidelberg, can speak English, but what would your telephones be to my Dutch workmen, who cannot talk English at all?'

"Well, I saw how the land lay. Old Val could not get it through his head that the telephone would transmit anything but the language of America. I was bound to make the deal, as I said before, so I remarked to Mr. Blatz:

"'I can put on some German receivers, if you so desire. I have some with me.'

"I connected up the 'phones, made a show of changing the receivers, and in half an hour Mr. Blatz was talking to one of his Dutchmen down in the malthouse. He was delighted.

"'You may put them in,' he said, 'and I shall want one German one in the malthouse, one German one in each warehouse, English ones in my office and the business office and a German one in the cold-storage house.'

"We closed the deal and Mr. Blatz was glad to pay $2 extra for each German enunciator we put in. When the 'phones were shipped from the factory I had them labeled German and English, re-

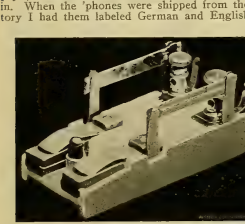


FIG. 1. CRIDER TELEPHONE SPECIALTIES.

spectively, and the big brewer was perfectly satisfied.

'It was five years before I saw Blatz again. He recognized me at once, and said with a hearty German laugh: 'You are the accommodating gentleman who put in the German and English telephones for me. Well, you are a good one.'"

Crider Telephone Specialties.

S. S. Crider of Sterling, Ill., has placed on the market the S. S. C. double-protective lightning arrester shown in the cut, Fig. 1. Experienced tele-

FIG. 2 CRIDER TELEPHONE SPECIALTIES.

phone men pronounce it an excellent device, highly efficient and well adapted to all classes of work. It is a spark and sneak-current protector. The telephone set shown in Fig. 2 is the S. S. C. portable counter and desk combination with no wall parts, save socket and plug like those used for electric-light connection. It is claimed that it will work over the same line and distance with Bell instruments and with equally good results.

The Telephone in the Orient.

English capital is developing the telephone business in the Orient, and, according to the financial statements of the companies engaged, is securing good returns on the investment.

The report of the directors of the Oriental Telephone and Electric company (limited) for the year ended December 31, 1897, which was presented at the annual meeting at London on April 27th, showed that the revenue account had a credit balance of £10,909 18s., including £629 14s. 3d. from 1896, and, after deduction of £2,858 8s., representing the interim dividend of 4d. per share paid on October 30th last, there remained £8,681 4s. 3d., which the directors recommend be appropriated as follows: £5,716 16s. in the payment of a final dividend of 8d. per share, free of income tax, making five per cent. for the year; £1,000 to extinquish balance debit of Colombo exchange "suspense account;" £1,000 to reserve, and £964 8s. 3d. forward.

The revenues of the Indian companies continue satisfactory. The Bombay company has paid a dividend of six per cent. against five per cent. for 1896, and has received from profits of the year a further sum of Rs.30,000, which has been decided desirable, in consequence of the continuance of the plague in that city and the unsatisfactory outlook in connection therewith.

The Telephone company of Egypt has declared the dividend on its six per cent. preferred shares, and its business still continues to develop.

The China and Japan Telephone company has paid its debenture interest, and is making fair progress both at Shanghai and Hongkong.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Western Electric Telephone company offers to extend its wires to Howard, S. D., if given sufficient inducement.

The telephone line between Springville and Whittier, Ia., is about completed.

The Iowa Telephone company has reduced toll rates from Columbus Junction, Ia., to Muscatine and Washington.

The Iowa Telephone company is cutting rates severely at Vinton, Ia., owing to efforts being made to establish a new company.

The local telephone company of Lake City, Minn., has just put in a new switchboard to enable it to handle 100 lines instead of 50, as heretofore.

Alline Brothers have accepted the management of the new telephone exchange at Fort Dodge, Ia. The company has over 200 instruments placed.

The Iowa Telephone company has established its office in new quarters in Independence, Ia., and will hereafter be open all night.

A local telephone exchange company is being formed at Benson, Minn.

The Northern Telephone company of Rush City, Minn., will extend a toll line to Minneapolis and St. Paul.

The Jefferson County Telephone company of Fairfield, Ia., voted to extend toll lines over the county to any place where sufficient encouragement should be offered.

Citizens of Red Oak, Ia., propose to establish a local telephone exchange.

The Iowa Telephone company is arranging to establish a telephone exchange in Dysart, Ia.

The Wisconsin Telephone company has now given Waupaca, Wis., an all-night service.

The Mississippi Valley Telephone company has deposited with the city clerk of Minneapolis a bond for $25,000 and an acceptance of the franchise recently granted.

The council of New Richmond, Wis., voted unanimously to request the application of the American Telephone and Telegraph company for long-distance connection. The council argued that it has county service over the independent lines and will soon have connection with Minneapolis and St. Paul over the same system. The council thought New Richmond had very little use for Chicago and New York connection. It also remembered in the days gone by the Bell company was implored to give the St. Croix valley telephone connection with the Twin Cities and would not give it. It is understood a similar application at Hudson, Wis., is likely to receive the same treatment.

Telephone systems are to be established at Rockwell City and Manson, Ia., at once.

The Union Telephone company of Richland Center, Wis., proposed a line between La Valle and Cazenovia. Late Saturday night it was learned that some farmers proposed a line along the same route. Twenty men were put to work on Sunday, and by Monday morning the 10 miles was completed, forestalling the farmers.

The Richland Center Telephone company will extend its lines to Reedsburg, Wis.

The Cedar Valley Telephone company is building a telephone line from Midland, Ia., to Traer, Ia.

The Wisconsin Telephone company will establish an exchange at Columbus, Wis., with 25 or more instruments.

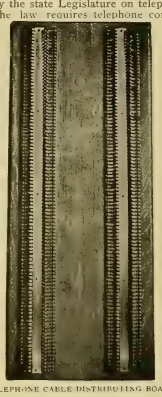
The Wisconsin Telephone company is preparing to build from Stevens Point, Wis., to Chippewa Falls, and north from Abbotsford, on the proposed line, to Ashland. It is expected to have these lines completed in about two months. The company recently proposed to establish an exchange at Marshfield. The council refused to allow it to enter Marshfield unless it would connect with the local exchange about to be put in. The Wisconsin company rejected this, but offered instead to take the local franchise and put in local and long-distance service. The council was willing to the company would work under its direction. This also was refused.

Telephone Cable Distributing Board.

F. Bissell & Co. of Toledo make the telephone cable distributing board shown in the cut. This board is suitable for use in an ordinary pole box or it can be placed on the wall of an exchange or elsewhere as may be desired. The cables are expected to enter from below or above, and the copper wires will spread to the inner rows of contacts on both sides. The connection is made by a screw provided with a washer. This joint should, of course, be soldered. All contracts are mounted on hard rubber backed by matched cast strips, braced. The whole is highly finished and is very handsome for station work. The fuse is also held by screw contacts, and the connection to the spider wire is made in the same manner as the cable wire and should also be soldered. The contacts are bent close to the ground strip, leaving a very short gap, which acts as a lightning arrester. The board can be used for a metallic circuit or a grounded or a common-return circuit. They are very compact. One with connection for a 200-wire cable takes a space only 16 by 40 inches. In this small space are connections for 200 cable wires, 200 spider wires and the fuses.

Telephone in Texas.

According to official returns the number of telephones in actual service in Texas is exceedingly small, taking into account the number of towns and the population of the state. A special telephone tax of 25 cents per annum for each instrument in use is imposed by the state Legislature on telephone companies. The law requires telephone companies to



TELEPHONE CABLE DISTRIBUTING BOARD

make a sworn statement to the comptroller as to the number of telephones in use. Following is a list of the companies and the number of instruments in operation at the close of the year, according to the comptroller's record:

Carter Kirwen Telephone company, Buffalo, three telephones.
Albany Telephone company, 18.
Abilene Telephone company, 127.
Bryan telephone exchange, 170.
Brownwood telephone exchange, 136.
Bosque Telephone company, 47.
Bosque County Telephone company, 5
Bonham Telephone company, 85.
Beaumont Telephone company, 80.
Buffalo and Centerville Telephone company, 3.
Calvert Telephone company, 42.
Corsicana Mutual Telephone company, 153.
Cuero Telephone company, 82.
Daly and Grapevine Telephone company, Tarrant county, 2.
Denton Telephone company, 61.
Eureka Telephone company, Gonzales, 10.
Gatesville Telephone company, 60.
Gonzales Telephone company, 72.
Hico Telephone company, 42.
Huntsville Telephone company, 72
Jewett, Centerville and Leona Telephone company, 7.
Leona, Deane's Store and Midway telephone line, 2.
Navasota Telephone and Construction company, 75.
Navasota Telephone company, 100.
Palestine Telephone company, 134
Round Mountain Telephone company, 7
Southwestern Telegraph and Telephone company, 8,604.

It will be seen from the foregoing list that the total number of instruments in use was 10,248, and consequently that the income from them amounted to $2,562. Judging from the increase already noted in the number of independent companies and the extension of their business, this sum will probably be doubled this year.

WAR NEWS.

[*Continued from page 269.*]

profession, but I really cannot tell anything about him."

Electrical Warship Machinery Successfully Tested in Action.—A significant paragraph of the Associated Press correspondent's report of the bombardment of the fortifications of Matanzas on April 27th is the following: "During the bombardment the New York's engines at intervals went slowly astern, keeping a steady range of 4,000 yards on Punta Gorda and 7,000 on Quintas da Recreo, the machinery working perfectly not only in the engine room but throughout the whole ship. This is especially true of the electric ammunition hoists and turret training gear, two of the most essential parts of a ship's equipment during action." This news is especially gratifying to those who have contended that the electrical transmission of power on shipboard is as reliable as it is convenient and economical. Of course the test is not actually conclusive, as the cruiser was not under the stress of an engagement with an antagonist of equal power, but it is still a valuable testimony to the efficiency of the motors during a time when the ship was using its gun batteries in earnest, with no especially prepared or favorable conditions for the electrical plant.

First Spaniard Captured.—Mr. John W. Ebert, who represents the Western Electric company in Mexico, scored the first victory over the enemy on April 20th, even before war was declared, as shown by the following extract taken from a newspaper, The Two Republics, published in Mexico: "Two gentlemen of this city recently paid a visit to the state of Guerrero on business connected with electric installation, Messrs. Ketchum and Ebert. On their return they stopped at Jojutla and put up at the hotel there. It happened that a Spaniard occupied one of two adjoining rooms, and the landlord, wishing to oblige the two Americans, by giving them these rooms, shifted the Spaniard to a down-stairs room. Messrs. Ketchum and Ebert went down to supper, and, on returning to their rooms, a revolver and belt, the property of Mr. Ebert, were missing. The landlord was at once notified and on inquiry found that the haughty Spaniard had been seen sneaking down stairs from above, where he had no business. The landlord charged him with the theft, which the Spaniard denied, and on the landlord insisting on searching his trunk, and the suspect refusing to permit same, a gendarme was called. The Spaniard again made objection and the jefe politico was called in to take a hand. He very soon settled the matter by locking the Spaniard up and keeping him in jail until he chooses to open his trunk for examination. There is no doubt that he stole the articles or he would not have hesitated to open and show up at first. So the first Spaniard has been captured by an American and held as prisoner. If every one of our boys does as well as Mr. Ebert the war will soon come to a close." Later advices direct from the seat of war state that the revolver and belt were found in the Spaniard's trunk and that he will spend six months in a Mexican prison.

Electricians in the Service.—Ensign J. B. Caboon, U. S. N., retired, has been ordered to report at the Brooklyn Navy Yard immediately for service. Mr. Cahoon is well known in the electrical business, having been prominently connected with the old Thomson-Houston company and other concerns.

General Greely, chief signal officer of the United States Army, has wired Capt. W. J. Lloyd that it is the expectation that a regiment of electricians will be raised for use in the existing war, but that no definite arrangements have been made. Captain Lloyd is the assistant district superintendent of the Western Union Telegraph company at Chicago.

The General Electric company has posted a notice at the works in Schenectady stating it to be "the intention and desire" of the company to re-employ all employes who may leave their work to enter the government service if the employes who thus display their patriotism are not "incapacitated for duty" after their terms of service.

Lieut. W. F. C. Hasson has been placed in charge of the electrical firing of the protective topedoes and mines in San Francisco harbor. Lieut Hasson is a well-known and experienced electrical man and was formerly a navy officer. He was chief of the electrical department of the California Midwinter Exposition.

Mr. Willard E. Case, vice-president of the New York Electrical society, has addressed a letter to Prof. F. B. Crocker of Columbia University in which he says: "In view of the fact that the efficiency of electrical fighting equipments on land and sea will form a vital factor in the present war, I would submit to you as the representative of the electrical department of Columbia University and as a member of the council of the American Institute of Electrical Engineers, the following suggestion: That the professional and skilled electricians of our universities, colleges and electrical societies shall form themselves into a body which shall supplement the electrical corps engaged in active work on the water and in the field, to be available to the government for expert advice in all matters relating to the utilization of electricity in naval and military operations, thus adding to the present regular expert electrical resources of the government."

Telegraphic Communication with the Philippine Islands.—The lack of a trans-Pacific cable under American control was keenly felt after the brilliant naval victory of Commodore Dewey and his fleet in Manila Bay on May 1st. The action was begun early on Sunday morning, but the news was not known in Chicago until eight o'clock in the evening, although the difference in time is ten hours in favor of this city. The Manila end of the route is, or was, under Spanish control, and so the news came by way of Madrid, although afterward some details were received through the British Foreign Office. At this writing (Thursday) no official report has been received from Commodore Dewey, but this delay is doubtless due to the exigencies of the military situation. Cable communication with Manila is controlled by the Eastern Extension Telegraph company, an English corporation. There is a single cable laid from Hongkong to the island of Luzon. This is the only means of telegraphic communication between the Philippine Islands and the rest of the world. The lines of the Eastern Extension company extend south from Hongkong and afford connections with the Indo-European and the Eastern Telegraph companies' systems. Northward from Hongkong the cables of the Great Northern company extend to Vladivostok on the coast of Siberia, which is the eastern terminus of the land lines connecting Northern Europe with the Orient. The original landing place of the Hongkong cable on the island of Luzon was at Cape Bolinao, about 90 miles north of Manila, a land line completing the connection, but the latter having been frequently cut by the insurgents, the company recently extended the line from Cape Bolinao to Manila by submarine cable. The ordinary commercial rate from Chicago to the Philippine Islands is $2.41 a word.

At this writing it is reported that the cable has been cut. A New York dispatch of May 2d gives Superintendent Smart of the Commercial Cable company as authority for the statement. He says: "This was not the work of insurgents. It may have been done by Commodore Dewey's orders, but my impression is that it was done by Spaniards near Bolinao, upon receipt of orders from Manila, which is in communication with Bolinao by a land and also by a sea line. If the submarine wire between Manila and Bolinao alone had been cut it would still be possible to communicate with Hongkong from Bolinao. The cable from Bolinao to Hongkong belongs to an English company, but the Spaniards would not hesitate to cut it, especially in view of their recent serious reverse." A London dispatch of May 3d says that tests from Hongkong show that the cable was cut 50 miles from Manila. A week or a fortnight may elapse before it can be repaired, it is said.

West Indian Cables Intact.—Contrary to a widespread impression and a direct statement in the daily newspapers, it does not appear that the United States government has as yet cut any submarine telegraphic cable. A late inquiry at the Chicago office of the Western Union Telegraph company by a representative of the Western Electrician elicited the information that no notice of the cutting of the Key West-Havana cable had been received. On the contrary the notice to employes not to accept code or cipher messages to go through Key West implied that the cable was in operation. The censorship of the messages sent over this cable is, however, rigidly maintained. Captain James Allen has gone to Key West to relieve Captain R. E. Thompson as censor of press dispatches. He is a native of Indiana, from which state he was appointed a cadet at West Point, in 1868. After his graduation from West Point, in 1872, he became successively second lieutenant, first lieutenant and captain in the Third Cavalry. In 1886 be became adjutant in the same regiment. His last place has been that of signal officer on Governor's Island.

At the New York office of the United States and Hayti Cable company, the following notice was posted on April 30th: "As the United States government has placed a censorship on code and cipher messages for places between Hayti and beyond, we are obliged to decline all messages except those written in plain language." Lieutenant Joseph E. Maxfield of the Signal Corps was installed as the government censor by General Greely.

All messages to Puerto Rico as well as to Spain and Cuba are subject to censorship. General Greely is reported to have said that at present there is no cable running from the United States that is not under proper restrictions as to the character of the messages sent. Gen. Greely has amicably adjusted these matters with the Western Union Telegraph company and with the Postal Telegraph-cable company. "Both of these companies," he says, "have patriotically accepted the restrictions placed upon them by the government, and no cipher messages are handled between this country and the West Indies over American cables except such as are exchanged between the officers of the United States and neutral ambassadors and ministers and the designated consular officers of the country they represent in the West Indies. While the government has nominally occupied those offices, yet the full telegraphic control remains in the hands of the officers of each company, and proper security is insured by swearing into the United States service the managers and assistants in the cable offices."

The Signal Service.—Capt. W. J. Lloyd, the chief signal office of the Illinois National Guard, has tendered the services of his corps to the government either individually or collectively, but as the Signal Corps of the regular army has been increased to 200 men, the services of the state signal troops will not be needed, for the present at least. Capt. Lloyd is a popular officer of the Western Union company in Chicago, and many of the men in his command are telegraphers. However, he has assisted the government by securing a portable gas generator for the captive balloon which is to be used in making observations along the Atlantic coast, as noticed in the Western Electrician of April 23d. This generator was made in Chicago and shipped to New York.

Until last October the Morse alphabet was used by the Illinois Signal Corps as a standard, but in order to make the work interchangeable with that of the Navy Department the Meyer code was later adopted. The members of the corps are all experts in the use of the heliograph, flag, torch and telegraph.

An elaborate signal-service system along the southern coast of Long Island, with 34 stations, will be manned by the New York naval militia. Should a patrol boat sight one of the enemy's ships approaching Long Island Sound or New York Bay she would immediately put in under full steam for the nearest life-saving station on the southern Lond Island coast and signal the militiamen stationed there of the approach of the invading ship. The news would be at once sent on by telephone to Fire Island, Quogue or Montauk Point, whichever station was nearest. These stations are in direct telegraphic connection with the navy yard at Brooklyn. So soon as the scout boat's message was received by telephone at one of the three signal stations named it would be immediately telegraphed to the navy yard.

It is said that for the first time in the experience of any army in actual service the commanding officers of the United States troops will have complete outfits for maintaining telephonic communication with the various brigades and regiments that go to make up divisions or corps of any army. For this the officials are indebted to General A. W. Greely, the chief signal officer. By means of the communication thus afforded commanders will be able to immediately send instructions to subordinates in the field and then receive reports of movements. General Greely also has equipped and ready for service his field telegraphic outfit.

Commodore Dewey Interested in Electric-light Signaling.—A report from Hongkong, brought by the steamer Gaelic, states that the night before the Gaelic left Hongkong (about April 8th) Commodore Dewey gave an exhibition of electric-light signaling. The commodore is particularly interested in this branch of naval tactics, as he was at the head of the naval commission which authorized and formulated the method and code. The passengers on the Gaelic describe the exhibition they saw as interesting. The signals were answered almost instantaneously from the other ships anchored at various distances and in various directions.

Wiring Along tho Coast.—Official notice has been given to navigators that submarine mines have been placed in New York and other harbors along the Atlantic and Gulf coast. The regulations allow no vessels to pass the entrances to the harbors between sunset and sunrise and give other rules for the safe navigation of friendly vessels. Patrol boats enforce the orders of the authorities, and a guard boat, the Surprise, is used to protect the mines and cables in the Narrows and New York Bay from the knives and nets of shad fishermen.

A dispatch from New Haven states that the Southern New England Telephone company has begun laying a set of private wires for the United States government along the shore of Connecticut, from Goshen Point, near New London, to connect that place with the main line. Other shore stations to be connected with the main circuit are Race Point, Sachem's Head, Sheffield Island, Noroton Point and Lighthouse Point. A cable will be laid across Long Island Sound to Sheffield Island. Two trunk wires have just connected the forts at the eastern entrance of the sound with New York and Washington. Major S. S. Leach has just purchased 65 miles of cable for the submarine mines to be submerged at New London, Fisher's Island, New Haven and Bridgeport harbors and at the mouth of the Connecticut River.

The plant of the American Electrical Works of Providence is running overtime getting out wire cables for the United States government. It is understood that the cables are to be used with submarine mines.

Miscellaneous Notes.—Key West is a frontier town in the present war, but the inhabitants accept the situation very quietly and take their afternoon siestas as usual. Business is undisturbed, and the Key West Street Car company is leisurely supplanting its horse-cars by an electric system, undismayed by the presence of soldiers and war vessels.

Electric fans are pressed into service in a Chicago department store to furnish the breeze to blow out American flags that are used indoors and which would otherwise hang limp and still.

There is a telegraph operator on duty at the White House day and night, and the president re-

ceives not only official and private messages, but has all of the Associated Press reports.

The Sprague Electric company, at its works in New York City, is running day and night upon contracts for interior conduit and power motors for the government. The interior conduit manufactured by the Sprague company is the standard of the United States government, and it is used upon a number of warships and cruisers.

Gardner C. Sims, the wealthy engine builder of Providence, has, it is said, volunteered for service as an engineer in the navy. He passed his examination, has been accepted and will serve on one of the auxiliary cruisers as chief engineer without pay. Other men of prominence have offered their services for engineering work. L. B. Perkins of Hartford, Conn., a designer of steamship engines, has volunteered, and will be commissioned chief engineer in the navy. Prof. W. S. Aldrich, professor of engineering in the University of West Virginia, has also volunteered and is now awaiting examination. Prof. M. E. Cooley of Ann Arbor, son of the late Judge Cooley, will receive his commission, and Prof. H. W. Spangler, head of the department of steam engineering in the University of Virginia, is to be examined.

On April 29th the three warships at Hampton Roads gave a brilliant exhibition of their searchlights. The Brooklyn had four in use, the Massachusetts and Texas two each. They flashed the lights on every ship at anchor in the roads. One of the armed steam launches doing picket duty three miles away started to sneak up on the fleet. The operators of the lights on the Brooklyn caught the launch when it was about two-thirds of a mile away and the next instant the lights from the Texas and Massachusetts were trained upon the approaching craft.

Governor Black of New York has received a letter stating that the Western Union Telegraph company will transmit at "government rate"—that is to say, at the regular United States government rate—all messages concerning the enlistment and movement of volunteers or state militia during the war with Spain.

WAR OPINIONS.

[*Continued from page 269.*]

either side, in which event business of all kinds will remain in a waiting attitude. If our government should push the war aggressively, successfully and quickly, I believe all business would feel a new impulse. There can, of course, be but one ultimate result of the war, though whether this will come in a few months or will be long deferred is the difficult question to answer. The fact that war will do no one permanent good, in my opinion, is not open to argument. Now that we are in it, it should be pushed with all the aggression, rapidity and strength that the country is capable of.

J. J. Nate, Standard Telephone and Electric company, Madison, Wis.: An opinion at this time as to the probable effect of war on the electrical industries of the country seems premature. It is, of course, quite apparent to everyone that in certain lines the industry must be benefited, as electricity enters so largely into modern warfare, and it is equally apparent that there are other branches of the business which must suffer. I may say these conditions are also applicable to other lines of manufacture. Many of our large transportation companies predict disastrous results should the war be of long duration. As a loyal American citizen, fired with sincere enthusiasm and appreciating our country's strength, I have confidence in the nation's ability to successfully and quickly deal with the present trouble. Having this confidence, I naturally feel that the war ultimately must result in benefit to the electrical industries of the country. In the meantime, however, the indications are far from favorable to a continuance of the revival of business so recently noticeable.

Elihu Thomson, Lynn, Mass.: I can hardly consider myself an expert on the matter, but I should say that the probable effect of the war will depend upon the length of time it takes to finish up the war. I can only regard war as a destructive process, and not as a constructive process, and the ultimate effect can hardly ever, it seems to me, be a beneficial one, although the atmosphere may be somewhat cleared by the war.

S. M. Hamill, Brush Electric company, Schenectady, N. Y.: If the war lasts only a few months I do not believe that it will materially affect the electrical business. If, however, a naval war lasts a year or two, which is possible, it will have a very disastrous effect on the electrical business, which, with it so far this year, has been very large.

Mr. Edison and the Duluth Trip.

To the committee of invitation of the Northwestern Electrical association Thomas A. Edison is said to have stated on Monday that it was his desire to attend the summer meeting of the association to be held on the steamer Northwest between Chicago and Duluth on June 10th to 13th. Mr Edison assured the committee, it is reported, that unless something unforeseen occurred he would make one of the party.

Electric Power Companies and Their Relation to Municipalities.[1]

By A. E. Lang.

Consideration of the relation on the part of an electric-power company to the station producing the current on the one hand and to the community consuming it on the other opens a field of thought and discussion quite beyond the possible limits of a single paper.

I must therefore touch but briefly the outlines of this field, with the hope of suggesting question that will bring out an interchange of views along practical lines.

There is a two-fold object which must be accomplished: First, the investment of capital must be made profitable to the investors, and, second, the community must be served in the best possible manner at a minimum cost.

It was only about 10 years ago that electricity was found to be a practicable means of propelling street cars, and it has developed so rapidly, that it has been quite difficult to secure men familiar with the work. Indeed, the demand at one time was so great that men were hurried through the shops of the electrical works, having acquired but little practical knowledge, soon to blossom out full-fledged electricians—but in name only. As a result of this hasty and insufficient preparation, these so-called electricians in many instances made mistakes, which were costly indeed, but, nothing daunted, they forged ahead and succeeded in constructing and equipping many miles of electric railway all over the country.

The insufficient knowledge of electricians was not only evident in the construction and equipment of the railways, but also at the power stations and the factories where the apparatus was manufactured. But notwithstanding the crudity of many things in the electrical line and the lack of knowledge in relation thereto, the public was bound to have it, and so property was purchased at enormous prices, a so-called electrical engineer was placed in charge, and the work carried on regardless of expense, and, I was about to say, of consequence.

I venture the statement, however, that could some of the owners of street railways using horse power, or some of the capitalists who ventured investment in the earlier electric-light plants, have foreseen the almost fabulous sums of money required to convert or construct the same, and the long time they would have to wait—and may still wait—for profits, there would have been much more caution and much less progress.

Once entered upon, there was no convenient stopping place, and in many and many instances none has yet appeared. But we may say this is American—truly American.

What has been said applying specifically to the street-railway plant is equally applicable to electric-lighting plants, so far as the power house, repair shop and overhead lines are concerned. Each furnishes power useful to the citizen, and each should be made profitable to its owners. As before stated, they are each closely related to the municipality, and the community expects and demands the best possible service at the minimum cost.

How can this be accomplished?

It must be borne in mind that many existing street-railway and electric light companies have passed through very costly experiments with crude machinery they were forced to buy, and inexperienced and incompetent persons employed to install and operate it. Finding that expenses were exceeding revenues, and grasping at every promising improvement offering greater economy, change after change has been made, and is still making, to reach better results, all of which has required increasing capital stock and the issuing of bonds.

There was no other way to avert failure and avoid the sheriff, and thus many companies have gone forward, piling up debt upon which interest must be paid, and still the end is not yet. Every new plant installed possesses some new features that offer better service, with greater economy, and this forces existing plants to again remodel and create more debt and consequent increased interest charges.

It is plain that the cost to the consumer must remain unchanged, except in the few communities where the conditions mentioned have not so largely prevailed.

A condition such as this is, of course, unfortunate, both for the community and for the company, and no doubt leads to much discussion of the question of municipal ownership of these properties. Vainly believing that the cost of such service can be materially reduced, and profits proportionately increased, municipalities desire to reap supposed harvest. This I believe to be erroneous under present forms of society and government.

I do not believe that municipal ownership of such properties is wise in any sense nor that much will be done in this direction, especially not if private corporations keep pace with the best methods of service and offer reasonable rates.

I am one who believes that the community will deal with these corporations fairly, if the corporations will be equally fair with the community. Some corporations are too exacting—too much inclined to reap a harvest of quick return by way of dividends and provide a rapidly accumulating sinking fund to wipe out original investment.

This method, though Yankee-like and generally called business-like, is not a prudent or wise way of handling corporations depending on the public for their existence. A better way, it seems to me, is to take the public into your confidence, deal fairly and even generously with it, give the best possible service at the smallest profit consistent with a fair return on the investment and reasonable provision for meeting outstanding obligations and future depreciation, in which event the community will deal fairly with you.

Citizens should be made acquainted with all the conditions governing properties of this kind, should be informed of the reason for incurring the debts which generally exist and of the annual and contingent burdens we assume. Fulfilling these conditions, fair prices will usually be allowed for transporting passengers upon our railways and for power and light supplied.

Where the company is left free to fix its own prices, no advantage should be taken, but a reasonable and just charge should be made as indicated. The tendency of the present age is toward lower prices for labor as well as for the product of farm and factory and lower interest on money, and electric power companies must meet it.

To do this, no better method can be found than by consolidating under one roof all electric power companies where conditions are favorable. Re-equip with the latest and best types of machinery for generating current, rearrange circuits for better power distribution, introduce better lamps, repair and keep in good order all the apparatus appertaining to the street-railway and light plant. Give the best of service!

There is frequently no other way to do this than through consolidation, and this can be accomplished without criticism or objection on the part of the community, if followed by reduced cost to the consumer, with first-class service rendered.

Corporations, like individuals, sometimes make mistakes, and through miscalculating the expense of construction and operation or in the eagerness to secure grants, or for various other reasons, they assume contracts upon terms and at rates and prices too cheap to permit giving the best of service, with the result that great dissatisfaction is expressed by patrons and citizens generally, and the warfare between the city and company begins. Furthermore, when such corporations have reasonably profitable contracts, they are sometimes mismanaged by their avaricious owners; scanty service is rendered their patrons, and the result is the same.

Again, municipalities, in some instances, through the prejudice or political aspiration of their governing boards, seeking advantage by every method known to their officials, harass corporations, and thus force them to retaliate by giving poor service.

Now, gentlemen, do you perceive the call for your labor and efforts? It is here where your skill is in demand, here where it is your power to work out the problems which will aid in putting this class of property into more profitable operation, satisfactory to owners and the community.

The power house, repair shop, cars, track and lines are the dividend producers, when skillfully and intelligently contructed and operated, and you are needed to carry on this work, needed now, perhaps, more than ever before, to pilot safely to a dividend basis plants of companies already existing—needed, also, to wisely inaugurate other enterprises of a similar nature, and thus extend still further the uses and advantages of this wonderful power.

The first consideration of every person as he enters the market to sell his labor or to invest his money in commercial pursuits is how large a return can he obtain, either from labor alone, or from labor combined with the investment of capital?

Either field is legitimate and proper, but by far the wider is that opened for the sale of labor; and its reward, if the labor be of a higher order, is abundant and certain. Investment of capital with hope of great returns is speculative and uncertain. If returns are steady, they are generally moderate.

I know of no field more promising than the electrical. In it young men of energy, perseverance and devotion can make a good living, and perhaps acquire a competency.

I have briefly indicated some of the problems which will confront you when you have entered into active service. It is needless to say that you cannot be too well prepared to meet them. Your ability and education, however, are not the only qualifications necessary to possess in order to succeed. Without an honest and faithful and constant devotion to the interest of your employer, no permanent success will be attained.

You are now acquiring scientific and, as far as possible, practical information in electrical engineering. Some of you will be called to manage electrical properties, to finance them, to look after municipal, county or state legislation. The broader your information concerning the subject, the higher degree of usefulness you will attain. There is to the student every incentive for faithful, industrious work. The possibilities are unlimited and the reward ample.

1. Lecture delivered at Purdue University, Lafayette, Ind., April 26, 1898.

The Water, Light and Power company of St. Cloud, Minn., has passed out of the hands of a receiver, and the company has been reorganized as the Gas and Electric company.

Chicago Edison Company.

The report of the Chicago Edison company for the year ended March 31st shows marked improvement in the condition of the central-station business of the city. The gross earnings were increased about eight per cent., while operating expenses were increased less than four per cent., and in proportion to gross earnings they are now the smallest in the company's history. An interesting comparison is made between the figures for the last fiscal year and those for the 15 months ended March 31, 1894, the latter including the whole World's Fair period. In the 15 months of 1893-94 gross earnings were $480,000 more than in the last twelve months, but operating expenses were $475,000 larger, so that in the last year the company earned practically the same amount net as in the 15 months ended March 31, 1894. In the last fiscal year the company's output of current was 70 per cent. greater than in the year 1894 and 15 per cent. greater than in 1896-7. This increase was accomplished, as shown, with an increase of only four per cent. in operating expenses, and during the year the price to the consumer was reduced, following out the company's well settled policy of intrenching against all possible competition by producing and selling current more and more cheaply. As to the growth of business in the last year, it may be added that the first six months of the year showed no increase over 1896. On the contrary there was a decrease. The last six months, however, showed enough increase to leave receipts for the 12 months $113,255 ahead. From 1894 on, the results achieved by the company are shown as follows:

Year ending March 31st.	Gross.	Optg.	Earned on stock.	Per ct. optg.
1895	$1 437,042	$953,377	$328,537	66 3
1896	1,461,084	898,517	404,432	61.5
1897	1,548,608	948,934	419,340	61 3
1898	1,661,863	985 338	449,844	59.3

The last year, as compared with the preceding year, shows larger earnings, reduced proportion of operating expenses and a larger surplus after dividend requirements were met. Out of this year's surplus $40,000 was charged to depreciation reserve. The figures of 1898 and 1897 are:

EARNINGS.

	1897-98.	1896-97.	Increase.
Gross	$1 661,863	$1,548,608	$113,255
Operating expenses	985,338	948,934	36,404
Net	676,524	599,674	76,850
Interest	226,680	180,334	46,346
Earned on stock	449,844	419,340	30,504
Dividends	398,072	397,518	554

The growth of the business during the year is shown by the following statement of business connected:

Incandescent lamps	259,496
Arc lamps	5,896
Motors (horse power)	8,415
Total equivalent in 16 candle power lamps, March 31, 1898	436,083
Total equivalent in 16 candle power lamps, March 31, 1897	355,140
Increase for fiscal year	80,943

The capital stock is the same as a year ago, but the company has issued $708,000 of the new bonds during the year. The proceeds went to improvement of plants, as that item increased $922,878. These are the only important changes shown by the balance sheet. The following gives all the items for two years, with comparisons:

ASSETS.

	March 31, 1898.	March 31, 1897.	Changes.	
Plants, real estate, etc	$9,553,208	$8,630,330	Inc.	$922,878
Work in progress, etc	161,549	136,405	Inc.	25,144
Accounts received	211,110	197,799	Inc.	13,311
Cash	86,826	206,541	Dec.	119,715
Open accounts	48,457	....	Inc.	48 457
Total	$10,061,151	$9,171,075	Inc.	$890 076

LIABILITIES.

	March 31, 1898.	March 31, 1897.	Changes.	
Capital stock	$4,975,900	$4,975,900		....
Bonds and debentures	4,458,000	4 750,000	Inc	$708,000
Accounts and notes payable.	279 213	131,066	Inc.	148,147
Open accounts	....	17,842	Dec.	17,842
Depreciation reserve	240,000	200,000	Inc.	40,000
Insurance fund	28,000	20,000	Inc.	8,000
Surplus	80,038	76,267	Inc.	3,771
Total	$10,061,151	$9,171,075	Inc.	$890,076

Depreciation reserve as here shown represents amounts charged out of earnings and set aside for permanent improvements to plants.

Philadelphia Electrical Exposition.

The Philadelphia Electrical Exposition company will give an electrical exhibition in its building, 818 and 820 Chestnut street, Philadelphia beginning on June 6th and continuing for one month. The building extends through to Sansom street and affords every facility to exhibitors to display their goods or machinery to the best advantage. In the center of the building there is a rotunda in which will be placed an electric fountain. A first-class orchestra will furnish excellent music, and no pains will be spared to provide all the conveniences necessary to insure the comfort and pleasure of visitors and exhibitors.

Various novelties of an electrical character will add to the genera[illegible] of the exhibition, and it is the intention of many of the prominent exhibitors at the New York exhibition to send their exhibits to the Philadelphia exhibition. Especial attention will be given to recent electrical inventions and to the exhibits of distinguished inventors when of an attractive character. The General Electric company will exhibit much of its apparatus of interest to the public. A working model showing the principle of Edison's magnetic iron-ore concentrating process will be shown; D. MacFarlane Moore will exhibit his recent form of vacuum-tube lighting, and many manufacturers have already signified their intention to exhibit.

Philadelphia is one of the best cities in the Union for such an exhibition, as generous support is always given by the residents to any first-class entertainment, to which can be added a large number of visitors from the neighboring towns. Great care will be taken in the selection of exhibits, none being admitted not germane to electricity. The building will be open from 10 a. m. to 11 p. m., and, with its accessibility, central location and the moderate admission fee charged, a large attendance both day and evening is expected.

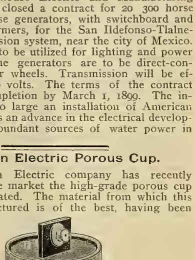
Intending exhibitors may obtain full information by addressing William D. Marks, the director, and diagrams showing location of spaces, together with other information, will be forwarded upon application.

Large Power Transmission Plant for Mexico.

The Westinghouse Electric and Manufacturing company has closed a contract for 20 300 horse power two-phase generators, with switchboard and raising transformers, for the San Ildefonso-Tlalnepantla transmission system, near the city of Mexico. The current is to be utilized for lighting and power in the city. The generators are to be direct-connected to water wheels. Transmission will be effected at 22,000 volts. The terms of the contract call for its completion by March 1, 1899. The introduction of so large an installation of American apparatus marks an advance in the electrical development of the abundant sources of water power in Mexico.

Western Electric Porous Cup.

The Western Electric company has recently placed upon the market the high-grade porous cup herewith illustrated. The material from which this cup is manufactured is of the best, having been



WESTERN ELECTRIC POROUS CUP.

subjected to a rigid test and stamped before being used. The upper portion of the jar is completely sealed, with the exception of two small vents for the escape of gas. All porous cups are stamped No. 6.

Tonawanda's Foresight.

The Niagara Falls Power company has just placed an order with the Westinghouse Electric and Manufacturing company for two transformers and the necessary apparatus for establishing a transformer station in North Tonawanda, which place is situated about midway between the Falls and Buffalo on the transmission line. Ever since the cables were strung through the Tonawandas, it has been the hope of the people there to profit by the nearness of the electrical power, and the awarding of the contract referred to is evidence that the Niagara Falls Power company has found customers there. The Tonawandas form the greatest lumber market in the country, and there are numerous factories and industrial establishments there that could, and probably will, use Niagara power to an advantage. As yet the site of the station has not been made public, but it is clear that Niagara's force is about to make captive another industrial center. When the franchise for the erection of the transmission line through the Tonawandas was granted, it was with rare foresight specified that the price to be charged for power there should not exceed 92½ per cent. of the lowest price charged for power in Buffalo for similar use, the argument being that there was less loss in transmitting power to the Tonawandas than there was to Buffalo, which is twice as far from Niagara Falls.

National Electric Light Convention, Chicago, June 7th, 8th and 9th.

The most popular line from Cincinnati, Louisville and all points South to Chicago is the Big Four Route via Indianapolis; magnificent sleeping cars and unequaled dining-car service. For maps, rates, etc., address E. O. McCormick, passenger traffic manager, Big Four Route, Cincinnati, O.

Government Contracts.

The following bids have been received by the public printer for furnishing and erecting seven electric elevators in the Government Printing Office at Washington, D. C.: Henry Vogt Machine company, Louisville, Ky., $11,901; Sprague Electric company, New York, $16,925; Otis Bros. & Co., New York, $15,480.

The secretary of the treasury has awarded the following contracts for the installation of an electric light and power plant in the United States postoffice building at Baltimore, Md.: Morton, Reed & Co., of Baltimore, $6,996 for the engines; Siemens & Halske Electric company, $4,558 for the dynamos.

The secretary of agriculture is considering proposals for furnishing the department with telegraph instruments, etc., during the next fiscal year.

Col. T. A. Bingham, in charge of the office of public buildings and grounds, Washington, D. C., is inviting sealed proposals until May 10th for furnishing electric battery supplies during the fiscal year which will begin June 30th. Information regarding the supplies required can be obtained upon application to the office.

CORRESPONDENCE.

New York Notes.

New York, May 2.—Everything is in readiness for the opening of the electrical exhibition at Madison Square Garden to-night. Chauncey Depew is expected to preside, at the invitation of Dr. Pupin, president of the New York Electrical society, and a large attendance is expected. The show has been extensively advertised, and its promoters are working hard for the success they deserve.

The Syndicate Construction company was recently incorporated with a capital of $50,000 to build and operate electric railroads in Union, Somerset, Middlesex, Mercer, Burlington and Camden counties in New Jersey. The incorporators are Gottfried Kruger and Andrew Radel of Newark, and Edward H. Radel of New Brunswick, all at present officers of the Brunswick Traction company. It is stated that the Brunswick Traction company has come to an agreement with the council of Somerville and will at once commence building an extension through the town.

A temporary injuction has been granted restraining the Kings County Traction company from parting with any assets of the Traction company, or with the right, title and interest of the Traction company in the capital stock of the Atlantic Avenue Railroad company. The proceedings were begun by Crowell Hadden, a shareholder of the Traction company.

M. S.

New England Notes.

Boston, April 26.—The Boston Elevated Railroad company has on exhibition at the rooms of the State Board of Railroad Commissioners very elaborate and comprehensive plans of the proposed routes. These are being carefully studied by real-estate owners and others who have a direct personal interest in the location of the elevated structure, and it is likely that the hearings to be held by the board on the question of approval will bring out a wide variation of opinions. It is the general opinion that the elevated company proposes to build a structure with the least possible delay, and of a character that shall embrace all that the most experienced engineers may suggest. On the question of an exchange of traffic between the elevated system and the new south station it is likely that some objection will be raised to the location of the proposed station across Atlantic avenue and on a line with Summer street. It will, no doubt, be strongly urged that some kind of a covered way, leading from this station to the big terminal, should be provided, if it is clearly shown that the number of passengers from the elevated to the terminal is likely to reach any considerable number. Expert opinion on this matter, so far as ascertained, is to the effect that the exchange will be of comparatively insignificant proportions.

It has been reported that the New York, New Haven and Hartford railroad was to equip about 10 miles of its Berkshire division with electricity, but an official of the company says that the plan has not been seriously considered. The part of the line referred to, forming a part of the old New Haven and Derby railroad, has a large passenger and freight traffic, and has been threatened in the last two Legislatures by parallel trolley schemes, one of which was with some difficulty defeated. It is a very vulnerable part of the New Haven system. The officer referred to says that, although it has but a single track, it can be operated both by electricity and steam by means of new sidings. In spite of this qualified official denial, the impression remains that the line may be equipped with the third rail in the near future.

C. S. G.

PERSONAL.

Mr. J. A. Colby, who for the last nine years has been general manager of the Edison Light company of Des Moines, Iowa, is spending a few weeks in New York. Mr. Colby will be remembered as one of the old Edison men, having been connected with the parent company some 12 years ago and also with the Sprague Electric Railway company. He is

well posted in the electric-lighting business, having had so many years of practical experience in the management of central-station work.

Mr. W. F. Osborne, for seven years the eastern representative of the Western Electrician, with office in New York, has resigned to become the business manager of the National Provisioner, a leading journal in the packing and provision trade. Mr. Osborne has given active, faithful and efficient service to the Western Electrician, and by his pleasing manners and personality he has made for himself a large number of warm friends among the electrical men of the East. Mr. Osborne's late business associates on the Western Electrician join with his other friends in wishing him a very complete measure of success in his new field of activity.

ELECTRIC LIGHTING.

G. S. T. Carnes of Memphis, Tenn., and H. H. Corson of Schenectady, N. Y., have franchise for the erection of an electric-light plant at Jackson, Miss.

ELECTRICAL SECURITIES.

The Erie Telegraph and Telephone company has declared a quarterly dividend of one per cent., payable May 7th.

The gross earnings of the Metropolitan Street Railway company of Kansas City from January 1st to March 31st were $1,614,270, against $1,466,827 last year.

The Brooklyn, Queens County and Suburban Railroad company reports for the quarter ended March 31st: Gross earnings, 1898, $162,664; 1897, $154,927; increase, $7,737; operating expenses, 1898, $104,589; 1897, $107,419; decrease, $2,830. The net earnings of $58,075 therefore showed an increase of $10,567.

The quarterly report of the Rochester Railway company shows a falling off in gross receipts of $8,669 and an increase of operating expenses of $1,086, as compared with the corresponding period last year, when, after paying fixed charges, there was $10,739 in the treasury. This year a deficit is reported of $54. The company's gross earnings this year up to March 31st amounted to $192,614.

The Long Island Electric Railway company reports gross earnings for March of $281,549, an increase of $20,070 as compared with the same month of last year, and net $36,726, an increase of $4,355. For the nine months ended March 31st the gross earnings were $3,480,261, an increase of $295,215 as compared with the corresponding period of last year, and net $1,061,887, an increase of $119,111. Fixed charges were $1,022,199, leaving a surplus of $136,948, an increase of $141,827.

POWER TRANSMISSION.

The correspondent of the Manufacturers' Record at Augusta, Ga., writes: "The Savannah River, a stream of varying moods, by turns loitering over the gentle slopes or tumbling over the rocky ledges, is capable of developing 400,000 horse power, according to an engineering estimate, from Trotter Shoals to the Augusta Canal, a distance of about 40 miles. The thriving little cities of Washington, Elberton and Hartwell, in Georgia, and Edgefield, Greenwood, Abbeville and Anderson, in South Carolina, can obtain all the power they require from this source for street railroads, electric lighting and industries by electrical transmission."

The Bolton Falls Electric company has been organized at Waterbury, Vt., to develop the Bolton Falls, 4½ miles north of Waterbury. On the Winooski River, at this place, there is a fall of 46 feet, and the power is estimated at 3,000 horse power. The company is now asking for estimates on water-wheels, penstocks, construction of dam and electrical equipment. Plans and information can be had from G. H. Almon, manager, at Montpelier, Vt. The company's directors are C. L. McMahon, Stowe, Vt.; G. H. Almon, Montpelier, Vt.; G. E. Moody, C. C. Warren and G. W. Randall, Waterbury, Vt. The following-named officers have been elected: President, G. E. Moody; vice-president, C. C. Warren; treasurer, C. L. McMahon; manager, G. H. Almon; clerk, C. D. Robinson

TRADE NEWS.

The Electric Arc Light company announces the removal on May 1st of its New York office to 120 Liberty street, the home of the Pioneer enclosed arc.

The Central Electric company of Chicago is carrying in stock all sizes of double and single, silk and cotton-covered magnet wire up to and including No. 40, and is prepared to meet all orders for these goods.

The Illinois Electric company announces that it has secured the Chicago agency for the 1898 type of Lundell fan motors, and is carrying a large stock of desk, bracket and ceiling fans. The Illinois company is doing an excellent business, not only in fans but in supplies generally.

The business of Jos. S. Wood, electrical engineer, of 25 Park Row, New York, and that of H. M. Shaw, manufacturers' agent, 126 Liberty street, in the same city, has been merged into that of the new firm of Wood, Shaw & Co., manufacturers, exporters and dealers in electrical specialties, with general offices at 40 Broad street, New York. The shops of the firm are fully equipped with machinery, tools, help, etc., for turning out the highest grade of work in the quickest time possible.

The Westinghouse Electric and Manufacturing company is to supply the electrical apparatus for the new plant of the Detroit, Ypsilanti and Ann Arbor Railroad company, consisting of four 300 horse power generators, three boosters, switchboards and ten car equipments, including 40 50 horse power motors.

The new catalogue issued by the Buckeye Electric company is being called for by lamp consumers in all parts of the country. The special coiled-filament Buckeye lamp is said to be the best that money and skill can produce. Western inquirers can write to J. H. Cooke, 753 Monadnock building, Chicago, for catalogue, prices, information, etc.

A charter has been issued to the George C. Towle Manufacturing company to manufacture electrical machinery at Lancaster, Pa. The directors are G. C. Towle, J. E. Hubley and R. Blickenderfer of Lancaster, Pa., G. A. Towle of Lowell, Mass., and J. P. Williams of New York. The company has the contract for making the Paragon fan and power motors for the season of 1898.

Designing engineers and power-house superintendents will find the new catalogue of power-transmitting machinery issued by the Falls Rivet and Machinery company of Cuyahoga Falls, O., a valuable one. It is clearly printed and illustrated, has an index and gives descriptions, dimensions and prices of pulleys, friction clutches, couplings, shafts, brackets, hangers and the like to the extent of 216 pages. The company has branch stores in New York, Boston and Cincinnati, and a branch office at 943 Rookery, Chicago.

The Electrical Exchange of Chicago reports great success with its new agency for the Midget Upton arc lamp. It has already secured orders for a large number of these lamps from all parts of the country. One shipment was sent to St. Michaels, Alaska. In addition to the regular line of Midget Upton lamps the Exchange is putting out a new Midget Upton alternating lamp, which is meeting with great success. The Exchange carries a full line of Midget Upton lamps in Chicago stock, and will be pleased to have prospective purchasers call and examine the various samples now on exhibition.

Attention is directed to the offer of the Ohio Electric Specialty Manufacturing company of Troy, O. This company will send to responsible persons any number of its own pure copper woven-wire brushes on 10 days' trial. If the brushes are not entirely satisfactory in every respect, the purchasers are requested to return them at the company's expense. This company has pursued this policy from the beginning of its business career, and the evident fairness of the proposition and the satisfactory results obtained from practical trials have gained for it a large and increasing trade.

The Fischer Foundry and Machine company of Pittsburg, under date of April 28th, issued the following statement: "The controversy between the Fischer Foundry and Machine company of Pittsburg, Pa., builder of the Fischer engine, and the Weston Engine company of Painted Post, N. Y., builder of the Imperial engine, regarding the infringement of certain patents relating to self-oiling engines, has been decided in favor of the Fischer Foundry and Machine company. This decision affects the majority of builders of self-oiling engines, and will probably result in a decided modification in the existing designs of this type of engine."

The Economic Power company of Rochester, N. Y., has in the last week placed orders with the American Tool Works company of Cincinnati, O., for a number of lathes, planers and milling machines. The American Tool Works company has also received orders through its office at Stockholm, Sweden, for a full line of engine lathes, ranging in swing from 14 to 30 inches, and through its office at St. Petersburg, Russia, an order for lathes, planers, shapers, drill presses and bolt cutters, which will be placed in the locomotive works at that place. Inquiries and orders from Mexico have also been coming in freely in the past three or four weeks, the company having booked a number of large orders from that country in the last week, among them being one from Compania Agricola del Tlahualita, at Zaragoza, Mexico, for a number of planers, lathes and shapers.

"Lightning Arresters" is the title of a short treatise, from the press of the General Electric company descriptive of the devices which that company has developed for preventing injury to electrical apparatus by lightning. The introduction is a short examination of the qualifications necessary to a perfect lightning-arrester, with a short disquisition on the special advantages of the magnetic blow-out. This is followed by concise descriptions of the arc and incandescent station arresters, already well-known as types "A," "AA" and "B." Greater space is given to the more recently developed lightning arrester for direct-current circuits up to 850 volts, and to the "G E" short-gap arrester, especially designed for alternating-current circuits and in use on almost all of the great electric power transmissions of the West. The booklet is well written and printed, the illustrations are excellent and the diagrams of connections clear and distinct. It is announced that "Lightning Arresters" will be furnished by the supply department of the General Electric company on application at any of the sales offices.

The proper lubrication of gas-engine cylinders has been a difficult problem. The problem, however, seems to have been successfully solved by an official of the Pennsylvania Railroad company. He writes as follows: "I had a gas engine at Sharon, Pa., running a pump, and the man that had charge of it allowed the lubricator to run dry and cut the piston, piston rings and cylinder. The makers of the gas engine said the cylinder would have to be sent to the shop and bored out and a new piston put in. It was our busy season and we could not do without water. I had some of Dixon's finely pulverized graphite, and I commenced to feed it into the cylinder through the suction pipe with the air and gas, with immediate relief. After about two weeks the engine was running smoother and using less gas than ever before. I had this same engine apart last Saturday, and every place that was cut is smooth as glass. This one instance saved us about $75. I have great faith in this graphite and always keep it on hand."

The Chicago Fuse Wire and Manufacturing company, whose factory was totally destroyed by fire on January 28th, is now in better condition than ever before for filling orders for tested fuse wire and links. This company calls attention to the fact that after the first of May all its fuse wire will be packed on the trademark spools which it has used for the last five years, and that these spools will in turn be inserted in neat individual tin boxes, which will protect the wire from danger of abrasion and also from being affected by changes of temperature. The company will carry a full stock of all sizes of wire, strip, links, telephone and telegraph fuses, and will make shipments from the factory in Chicago or its eastern office at 853 Broadway, New York city, as may be most convenient to the trade. W. R. Goodman, the manager, says that the great consideration shown to the company by all its friends in the trade during a few weeks of enforced suspension of business after the fire is highly appreciated.

BUSINESS.

The Berlin Iron Bridge company of East Berlin, Conn., has just completed for the Conway Electric Street Railway company, at Conway, Mass., a steel bridge to carry its electric line across the Deerfield River. This bridge is about 300 feet in length.

The Technic Electrical Works of 214-218 New street, Philadelphia, has issued "pocket price-lists" of knife switches and isolated-plant switchboards. These folders contain not a little information, compactly arranged, and are convenient for the pocket.

The Jandus enclosed alternating arc lamp shows an average efficiency, it is claimed, of 95 per cent. It burns singly on the same circuit with incandescent lamps, and gives a steady and brilliant light, with noiseless mechanism. The Chicago office is at 753 Monadnock building.

The book of general information and catalogue of telephone supplies issued by the Farr Telephone and Construction Supply company, 357 Dearborn street, Chicago, contains much valuable information and will be found of great assistance to all interested in telephone exchanges.

The well-known house of John A. Roebling's Sons company, which has a Chicago store at 171 Lake street, has issued a booklet on telephone cables and their equipment and installation. The pamphlet contains much useful information for the telephone-construction man, including useful hints, with drawings, on the splicing of joints.

The Western Electric company has designed fan motors that are to be connected up directly with 220 or 550-volt circuits without the intervention of any resistance. This company also states that three of its 110-volt motors or two of its 220-volt motors can be run in series on 550-volt circuits, and the 550-volt motor can be placed on 600-volt circuit.

The new observation car on the New Pennsylvania Limited is the finest car of the kind. It leaves Chicago Union Station 5:30 p. m. daily over Pennsylvania Short Lines. The Allegheny Mountains are crossed by daylight, and present an imposing sight from the observation room or open observatory. For particulars apply to H. R. Dering, assistant general passenger agent, 248 South Clark street, Chicago.

J. E. Keelyn, president of the Western Telephone Construction company of Chicago, has just closed a deal for control of the Graham Electric company's telephone and switchboard business as well as all of its patents. It is said this is the fifth concern that has been arranged for in like manner recently. A strong combination seems to be imminent, with Mr. Keelyn as president, and a strong financial syndicate backing it.

The Packard mogul lamp continues to stand alone in the field, it is claimed, as the largest successful incandescent lamp. The trade has settled down quite generally to the 300 candle power size, and this is now being used very extensively for lighting where large units are required. It is an interesting fact that a large number of the first mogul lamps that were made several years ago are still burning and giving good service.

The Central Electric company, Chicago, is n

troducing a new and ingenious device for ceiling clusters, consisting of a porcelain block with a metal canopy, which attaches directly to the ceiling, having the sockets embodied as a component part of the fixture. The clusters are furnished in various sizes from two to five lights and are especially designed for street-car work. Special circulars relating to this device can be had on application.

The New Vancouver Coal company, Nanaimo, British Columbia, has ordered a 175 horse power engine from the Ball Engine company, Erie, Pa., for electric mining purposes. The Chappell Chemical company of Hegewisch, Ill., will have an electric-light plant. A Ball engine furnishes the power. The American Ordnance company, Lynn, Mass., has ordered, through J. H. Houghton, Boston agent of the Ball Engine company, Erie, Pa., a 125 horse power engine for use in government work.

Problems of special difficulty have been solved by the Westinghouse Electric and Manufacturing company in the construction of the apparatus recently shipped for the works of the Carborundum company of Niagara Falls. One thousand horse power is supplied at voltages varying from 80 to 300. The work involves special difficulties on account of the wide range of voltage and the very large currents carried. The apparatus as designed by the Westinghouse staff is of high efficiency and power factor.

During the warm weather it is necessary to make places of business cool enough to enable the occupants to accomplish their usual amount of work and to do it in comfort. For this purpose it has been found that the Western Electric 1898 desk and bracket-fan motors are excellent. Their convenient size, three speeds and good mechanism (all of which are described in detail in Bulletin 2-F, issued by the Western Electric company) make them most desirable. A copy of Bulletin 2-F will be mailed to anyone requesting it.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 26, 1898

602,872. Process of Producing Chemical Compounds by Electrolysis. Joseph W. Richards and Charles W. Roepper, Bethlehem, Pa. Application filed July 6, 1897.

The process described consists in passing an alternating current through electrodes of similar composition immersed in an electrolyte, one or more of whose constituents forms alternately at each electrode, by electrolytic attack thereon, a compound partially derived from the consumption of that pole, which is insoluble in either the electrolyte or the products formed at the opposite pole for the time being, and which is precipitated from the electrode of consumption.

602,873. Process of Electrolytically Manufacturing Metallic Sulphides. Joseph W. Richards and Charles W. Roepper, Bethlehem, Pa. Application filed July 6, 1897.

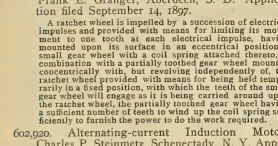
The process of manufacturing pure metallic sulphides consists in employing an anode of or containing the metal or metals whose sulphide is desired in a solution containing a hyposulphite salt as an electrolyte in conjunction with any suitable cathode, passing a current of electricity therethrough and precipitating the sulphide of the metallic base present in the anode.

602,895. Electrical Selector. Louis W. Crofoot and Frank E. Granger, Aberdeen, S. D. Application filed September 14, 1897.

A ratchet wheel is impelled by a succession of electrical impulses and is provided with means for limiting the movement to one tooth at each electrical impulse, having mounted upon its surface in an eccentrical position a small gear wheel with a coil spring attached thereto, in combination with a partially toothed gear wheel mounted concentrically with, but revolving independently of, the ratchet wheel provided with means for being held temporarily in a fixed position, with which the teeth of the small gear wheel will engage as it is being carried around upon the ratchet wheel, the partially toothed gear wheel having a sufficient number of teeth to wind up the coil spring sufficiently to furnish the power to do the work required.

602,920. Alternating-current Induction Motor. Charles Steinmetz, Schenectady, N. Y. Application filed February 12, 1897.

The method of compensating for the self-induction and magnetizing current of an alternating-current motor con-



NO. 602,895.

sists in inducing from the secondary of the motor leading currents in a tertiary closed circuit in inductive relation to the secondary motor-circuit.

602,921. Alternating-current Induction Motor. Charles P. Steinmetz, Schenectady, N. Y. Application filed February 12, 1897.

The method of starting and running an alternating-current motor, consists in passing alternating current through a primary winding, generating thereby a current in a secondary winding, inducing by the joint action of the primary and secondary windings an electromotive force in a tertiary winding, and causing the current in the tertiary winding to lead the electromotive force.

602,922. Electric Arc Lamp. Elihu Thomson, Swampscott, Mass. Application filed November 4, 1897.

Carbon-feeding mechanism is employed, together with a thermo-electric expansive device and a series electromagnetic controlling apparatus responsive to variations in the current passing through the lamp governing the operation of the thermo-electric expansive device.

602,923. Trolley. James E. Wells, Syracuse, N. Y. Application filed May 1, 1897.

A contact frame comprising sides arching in opposite directions, cross bars connecting them, one side having a longitudinal groove in its upper face or edge, and the other having a rigid longitudinal flange and a rolling contact mounted between the sides, combined with a suitable trolley arm upon which frame is mounted.

602,925. System of Electric Metering. Herbert C. Wirt, Schenectady, N. Y. Application filed December 31, 1897.

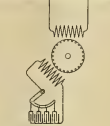
In a multi-rate electric meter there is the combination of a motor mechanism for registering the consumption of energy in an electric circuit, a recording mechanism which governs the speed of the motor mechanism, and means for altering the retarding or braking effect to change the rate of registration during coal in portions of the day.

602,950. Electric Massage Appliance. Fred J. S Lan, Kansas City, Mo. Application filed July 23, 1897.

A medical battery is attached to a device resembling a pressing iron, having a handle connected thereto, and a smooth roller mounted within the frame, and fluted rollers also mounted within the frame, together with a plate interposed between the fluted rollers and carrying a sponge, and a separate disk, one wire from the battery being attached to the plate and the other wire to the disk.

602,953. Electric Luminous Alphabet and Board for Same. Daniel M. Moore, Newark, N. J. Application filed December 17, 1895.

An illuminating character consisting of a translucent hollow vacuous receptacle is provided with hollow, lateral, recurved, extending projections in combination with separated terminals of an electric circuit adapted to removably hold one or more of the characters.



NO. 602,921.

602,963. Distribution of Electric Currents. Elihu Thomson, Lynn, Mass. Application filed December 6, 1886. Renewed February 26, 1898.

The main or principal circuit is supplied with rapidly varying electric currents, and there is also a local or independent circuit with an induction apparatus placed between the mains and the local or independent circuit, reaction coils in the primary circuit of the apparatus, and means for varying the number of coils in which the reaction is set up without short-circuiting them.

603,027. Rheostat. Roscoe W. Ney, New Rochelle, N. Y. Application filed February 5, 1897.

The apparatus comprises a suitable supporting frame, end pieces, and two bars which connect the pieces together, a metallic strip secured to the upper end piece, and to which is attached a binding-post; and the resistance strips, combined with suitable contact pans to which the ends of the resistance strips are secured, but which contact pans are electrically separated from each other. The binding post and the connecting strip connected to the post, and a switch which has its edge to pass under the ends of the contact pans.

603,041. Electrostatic Generating Machine. Adrian H. Hoyt, Penacook, N. H. Application filed August 9, 1897.

One claim is given: In an electrostatic generator, the combination with the terminals for the working circuit of spark-gap arms adapted for longitudinal and rotative adjustment within their posts.

603,042. Hinge Connection for Electrical Measuring Instruments. Adrian H. Hoyt, Penacook, N. H. Application filed November 1, 1897.

An electrically connected hinge is described comprising a stationary member composed of two blocks of metal joined by a hollow shaft or cylinder, one of the blocks having a small perforation or socket near the opening leading to the hollow shaft, a movable member having an arm projecting from its edge adjacent to the stationary member provided near its outer end with a lateral projection fitting the small socket in the stationary member, a copper ribbon passing spirally around the hollow shaft and having its ends soldered or otherwise rigidly attached one to the shaft and the other to the movable member, and set-screws threaded to perforations in the stationary member and communicating with the opening in its shaft.

NO. 602,963.

603,050. Incandescent Electric Lamp. Mark W. Dewey, Syracuse, N. Y. Application filed July 22, 1891.

The combination is claimed of a carbon filament with a receiver made entirely of glass and completely inclosing the filament, and from which receiver the air has been exhausted, and a coiled electric conductor outside of the receiver and in inductive relation to the inclosed filament.

603,058. Electrical Retort. Hilliary Eldridge, Daniel J. Clark and Sylvain Blum, Galveston, Tex. Application filed June 28, 1897.

Apparatus for manufacturing hydrogen gas by electrolysis comprises a retort having an insulated cover, an upright frame clamped to the retort and provided with a guide head and a stuffing box mounted on the cover and having insulating bushings in line with the guide head, combined with an anode passing through the guide head and stuffing box, a feed mechanism for the anode, a cathode and electrical connections for the anode and cathode.

603,060. Electric Railway. Charles F. Holtmann and Charles Bergmann, Pittsburg, Pa. Application filed August 5, 1897.

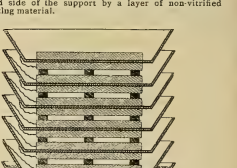
A series of separated successively arranged contact boxes, a fixed interior metallic contact plate arranged longitudinally within the bottom of each box and provided at its ends with upwardly disposed contact lugs or projections, a normally spring-elevated, straight-track section arranged longitudinally above each box, each track section being of a U-shape in cross section and carrying a depending connecting post, and a horizontal contact bar fitted between its ends to the lower extremity of the connecting post and provided with oppositely-located pairs of keeper plates adapted to engage with the contact lugs or projections.

603,061. Device for Turning off Commutators of Dynamos or Motors. William H. Jordan, Brooklyn, N. Y. Application filed January 28, 1897.

A tool is carried by a rotating and longitudinally movable shaft, a bearing for the shaft adjustable toward and away from the commutator, a driving wheel adapted to be journaled on either end of the bearing and by means of which the shaft is rotated and through which driving wheel the shaft is longitudinally movable, and a driving connection between the wheel and the commutator.

603,063. Rheostat. Harry W. Leonard, East Orange, N. J. Application filed July 28, 1896.

A support is covered by a layer of partially vitrified insulating material with a layer of vitreous insulating material on the first layer, and a conductor held to the insulated side of the support by a layer of non-vitrified insulating material.



NO. 603,229.

603,069. Electric Cable. Nathaniel G. Warth, Indianapolis, Ind. Application filed October 25, 1897.

This cable has its dielectric composed in part of fabric or like solid insulating material, and in part of compressed insulating gas confined for service as a dielectric.

603,112. Electric Lamp. David Misell, New York, N. Y. Application filed October 9, 1897.

An improved electric lamp comprises a casing, a battery carried thereby, a lamp in connection with one of the poles of the battery, a bowed-spring contact plate in connection with the other pole of the battery, and a handle in operative connection with the lamp and the spring contact plate, whereby a positive circuit connection against jarring or jolting is provided.

603,184. Electro-pneumatic Piano Player. Fred R. Goolman, Los Angeles, Cal. Application filed May 5, 1897.

The inventor describes an air-duct bridge, comprising a block channeled with parallel air-ducts, each duct having a lateral opening communicating in an enlarged recess covered by a flexible diaphragm, and electrical contact points arranged outside the diaphragm and adapted to be brought into electrical connection by the bulging or lateral movement of the diaphragm from pneumatic action.

603,198. Electrically Propelled Vehicle. Henry G. Morris and Pedro G. Salom, Philadelphia, Pa. Application filed September 29, 1896.

The front axle has a motor mounted thereon, and a forward structure forming part of the vehicle body is located directly above the front axle and carries the battery.

603,229. Storage Battery. Edward A. Barber, Watertown, N. Y. Application filed September 13, 1897.

The asphalt coverings for the series of superimposed metallic trays are described, the independent positive plates resting on the bottom of the trays, insulators across the positive plates, negative plates resting on the insulators, combined with the independent electrical connection between each of the plates and the side of the adjacent tray, which connections are wholly immersed in the electrolyte.

Western Electrician.

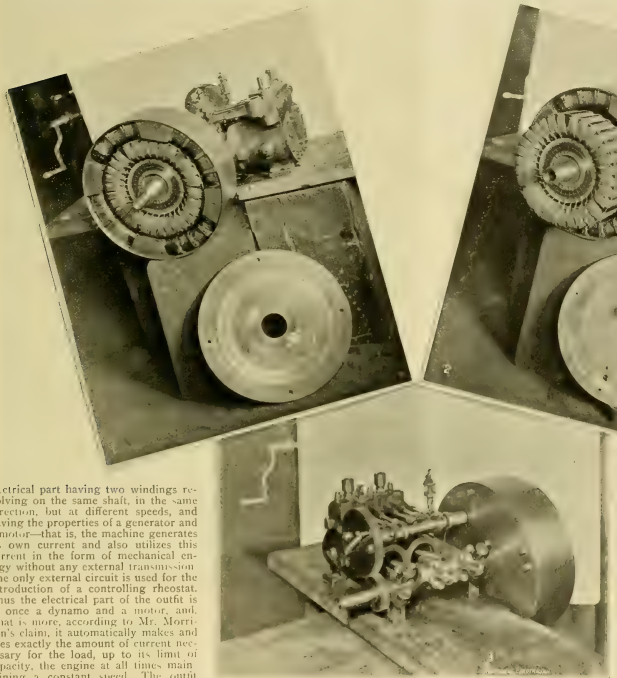
EVERY SATURDAY.

Vol. XXII. CHICAGO, MAY 14, 1898. No. 20

Morrison's Apparatus for Power Conversion.

William Morrison, the Chicago inventor, whose work is especially well known in the line of storage batteries and electric carriages, has devised the apparatus which is illustrated by the group of pictures given herewith. These pictures are reproductions of three photographs of the same machine, showing it complete, ready for operation (Fig. 3), and also with the inner electrical parts displayed (Figs. 1 and 2). The machine is small, but its operation involves an interesting electrical principle. It consists of an engine of about four horse power, adapted to be operated by gasoline, oxy-hydrogen or oil, and an electrical part having two windings revolving on the same shaft, in the same direction, but at different speeds, and having the properties of a generator and a motor—that is, the machine generates its own current and also utilizes this current in the form of mechanical energy without any external transmission. The only external circuit is used for the introduction of a controlling rheostat. Thus the electrical part of the outfit is at once a dynamo and a motor, and, what is more, according to Mr. Morrison's claim, it automatically makes and uses exactly the amount of current necessary for the load, up to its limit of capacity, the engine at all times maintaining a constant speed. The outfit was built for vehicle propulsion, but it may be adapted for other purposes. The objection will arise: Conceding that the electrical design is correct, why burden the machine with the electrical part at all, as the power can be used direct from the engine shaft to the driving axle of the vehicle? In answer Mr. Morrison contends that experience has shown that the starting torque, great flexibility and ease of control of the electric motor are necessary to the satisfactory operation of horseless carriages. To obviate the weight of storage batteries he generates the current on the vehicle by a light prime mover, and as a comparatively heavy balance wheel would be needed in any event for an explosive engine, he takes advantage of the fact by making his flywheel, in effect, the electrical generator and motor. Thus the weight of the generator and motor is practically saved.

The outfit as shown in Fig. 3 weighs about 200 pounds, and, as stated, it has a capacity of exerting about four horse power. The gas engine has twin cylinders, side by side, 3½ inches in diameter and 3½-inch stroke. At full speed it operates at 600 revolutions per minute. An ingenious centrifugal governor, designed by Mr. Morrison, is placed on the inside of the larger gear-wheel shown in Fig. 3, and automatically controls the speed of the engine. The gear-wheel is geared to the engine shaft and of course increases in speed with it. When the speed increases beyond the point for which the retaining spring is adjusted, the centrfugal force causes the governor to fly outward, and through the medium of a series of cams and rollers on the shaft driven by the large wheel the exhausts in the ignition chambers are opened and the engine takes nothing but air until the speed of the engine is again reduced. This regulation automatically establishes the speed of the engine within narrow limits during the period of its operation. The engine is water jacketed, and will be muffled in service on vehicles. It is designed to run at constant speed during the trip of the vehicle, whether the latter is going fast, slow or standing still.



MORRISON'S APPARATUS FOR POWER CONVERSION

The bronze cylinder shown on the right in Fig. 3 and uncovered in Figs. 1 and 2 embraces the electrical part of this interesting apparatus. The cylinder itself, with the outer coils, which may be called the field magnets, revolves at the constant speed of the engine, being securely keyed to the main shaft. The shaft extends through the cylinder. Mounted upon it is a Gramme ring armature, with a commutator within it. The armature is simply slipped on the shaft and is free to revolve upon it. The heads of the cylinder are fiber plates. The outer one, shown removed and below the machine in Figs. 1 and 2, is provided with copper contact rings for the rheostat connection on the outside (Fig. 1) and carbon brushes adapted to make contact with the commutator and wiring connections on the inside (Fig. 2). If the armature of this machine were held stationary, it would simply be a direct-current dynamo with revolving field-magnets having a capacity of about 15 amperes at 170 volts. If the armature were not held back in any way it would adopt its natural tendency to follow the revolving fields and no current would be generated at all. But Mr. Morrison has attached the load of the driving gear of the vehicle to the armature shaft—not to the fixed-speed field-magnet and engine shaft—and so the armature is retarded in its natural tendency, generating a varying current, as the armature wires cut a greater or lesser number of lines of force. In utilizing this tendency of the revolving armature to "catch up" with the faster revolving field coils, but always held back, more or less, when the load is on, lies the kernel of Mr. Morrison's invention. But it will be interesting to have an explanation in his own words:

"Assuming the carriage to be at rest, the armature of the transmitting mechanism is also stationary. Notwithstanding this fact, the prime mover may continue to revolve the field about the armature.

"It is a well-known principle in ordinary dynamo machines that as the speed of the armature is increased the current generated increases, and as the speed decreases the current decreases.

"When the vehicle is at rest the armature of the apparatus is stationary, and in starting, after the electric circuit is closed, the greatest current is generated and the greatest pull exerted upon the armature by the field, which force is transmitted to the carriage through the connection between the carriage and the armature. This results from the fact that in starting the field revolves about the stationary armature at approximately the highest rate of velocity. When the resistance of the carriage is overcome, in starting, the armature commences to rotate in the same direction as the revolving field, and the current generated and pull exerted then depend upon the relative difference of speed be-

tween the armature and the field. As the speed of the armature gradually increases the relative difference of speed between the armature and field decreases, the current generated decreases, the energy exerted diminishes and consequently the speed of the carriage, connected with the armature, increases. This continues until the resistance of the carriage, now under way, and the pulling force or energy of the apparatus becomes equal, when the carriage is then driven at its highest speed. Under conditions of unobstructed, level roadway, the field revolves about the armature at such a relatively greater speed as to generate a current and consequent energy sufficient to propel the carriage at the highest rate of speed.

"When the resistance of the carriage is increased by a grade or other obstacle, the speed of the carriage and the speed of the armature connected therewith is decreased, and as the field revolves about the armature approximately at a constant rate of speed, the relative difference of speed between the field and the armature is increased, thus increasing the current generated in proportion to the increased resistance of the carriage, and in consequence energy is exerted sufficient to overcome this increased resistance of the carriage."

Mr. Morrison makes provision for a rheostat in circuit with the field and armature to vary the speed of the carriage and to open and close the circuit at will. He claims to have done away with the use of a motor as a separate machine, but to have combined the advantages of the light gas engine and the flexible electrical system. Any suitable means of transmitting the power of the armature to the driving axle of the vehicle may be employed.

Electrical Plant at the Paris Exposition.

Recent statements make it appear that the electrical generating plant at the Paris Exposition of 1900 will be of 26,000 horse power, or somewhat smaller than that at the World's Fair at Chicago in 1893. The lighting will be entirely electrical and will enable all the buildings to be open after dark. The amount of current required for this purpose will necessitate machinery of 15,000 horse power. Then, again, it is proposed to have all the machinery, wherever exhibited, in motion, and the necessary driving power for this purpose will be electricity, for the production of which another 5,000 horse power will be required. Two buildings will be devoted to the boilers. In the one will be boilers of French origin and in the other those of foreign make, and a comparison of the work done by them will not be the least interesting portion of the exposition to engineers.

New York Electrical Exhibition.

The close of the first week of the electrical exhibition in Madison Square Garden, New York, found the show complete, in the sense that all the preparatory work had been done and also in the sense of worthily representing all the varied applications of electricity. The two features which were the last to be in readiness were the illuminated fountain and the illuminated cascade. The work on these features was interrupted by the accident which befell Thomas A. Edison, Jr. Mr. Edison, while erecting the cascade at the rear end of the garden, fell and injured his left hand and arm. But he recovered from the hurt sufficiently in two days to again supervise the work in person.

Beside these attractive features there are many interesting "show" displays, such as the illuminated tower, the tank in which is demonstrated the explosion of submarine mines for the destruction of warships, the Edison magnetic ore concentrator, the Moore exhibit of vacuum-tube lighting, the theatrophone, the generating plant, display of historical tableaux and experiments in "wireless" telegraphy.

The show is given under the auspices of the New York Electrical Society, of which Dr. M. I. Pupin is president and Mr. George H. Guy secretary. The members of the society have worked hard for the success that has been attained. So have Mr. C. O. Baker, Jr., the president of the Exhibition company, Mr. Marcus Nathan, the general manager, whose experience in the previous electrical exhibition has been the groundwork for the success of the present enterprise, and Mr. T. C. Martin, the chairman of the auxiliary and educational committee.

One of the really instructive exhibits is the large and prominent display made by the Edison Electric Illuminating company of New York, which shows many of the applications of electricity to industrial and household purposes. The spectacular vacuum-tube lighting display arranged by D. McFarlan Moore is also interesting and impressive. Its principal feature is a small chapel lighted from a vaulted roof which has arches made of the glass tubes. All of the tubes—16 arch and three ridge tubes—are connected in multiple are between three wires. The common or positive wire extends along the ridge, while each of the two negative wires extends horizontally along the sides of the chapel back of the side fixtures, which rest on top of the pilaster caps from which the tube arches spring. The three wires enter the top of a polished oak cabinet, which contains all of the light-controlling apparatus and is situated on one side of the entrance passageway.

Signaling Through Space.

A year ago but few people were aware of the fact that it was possible to signal through space without the aid of wires, but for many years it was well known to scientists that this had been accomplished for short distances. Last summer Mr. Marconi, a talented young Italian student, following in the pathway of Lodge, Branly and other experimenters, found that it was possible to transmit signals through space to a distance of over 10 miles. Mr. Marconi accomplished this wonderful result by means of some slight changes in the arrangement of well-known apparatus, and also by using at the transmitting and receiving stations a perpendicular wire suspended from a high point in the air. But while Marconi has accomplished much, an American inventor has designed apparatus which is suitable for practical use, without constant attention to fine adjustment. Mr. W. J. Clarke of New York city has invented this new system, and the exhibition of his company in Madison Square Garden certainly pays a high tribute to Mr. Clarke's inventive ability.

In the center of the south gallery is placed the transmitter, which is contained in an insulated glass showcase and consists of a suitable storage battery which is connected to a specially constructed induc-

NEW YORK ELECTRICAL EXHIBITION.—LOOKING NORTH FROM TWENTY-SIXTH STREET SIDE.

tion coil placed immediately above it, the current from the battery, however, first passing through an automatic circuit-breaker placed in front of the battery. This circuit-breaker takes the place, for exhibition purposes, that a telegraph operator would when repeatedly calling "N. Y.," "N. Y.," "N. Y.," "N. Y.," which is the well known telegraph call for New York city. It will be seen, therefore, that the primary circuit of the induction coil being interrupted in this manner, the secondary or sparking circuit of the coil will also work intermittently in response to the workings of the primary, so that the sparks coming from the secondary of the coil, instead of being the ordinary continuous four-inch sparks, will alternate with each other in such a manner that anyone standing by the case and listening to the sparking can readily recognize the Morse signals "N. Y." "N. Y." "N. Y." This, however, does not complete the entire transmitting apparatus, as the secondary terminals of the coil are connected to what is known as the Clarke electrical oscillator, which consists of two large brass balls placed about ¼ quarter of an inch from each other, and also two smaller balls placed about a half inch from the larger ones. The secondary terminal of the coil being connected to the smaller balls, the sparks will pass these sparks passing in this way produces violent across between all of the four balls, and the fact of

electrical oscillations, which in turn generate invisible electric waves which go out into space in the form of ever-increasing spheres, something in the same manner as the widening ripple in a pool of water if a pebble is dropped in. These spheres have the power of passing through any material, the walls of a building or a crowd of people presenting no appreciable impediment to the passage of the waves. In the center of the north gallery is the Clarke receiver, the most essential part of which is known as the coherer. This little coherer is a most interesting piece of apparatus, and consists of a glass tube in which are fitted two sliding plugs of metal, so arranged that the distance between them in the center of the tube is adjustable, the space between the plugs being filled in with a prepared metallic powder. This powder when lying in its normal condition presents a very high resistance to the passage of the electrical current, often amounting to over 20,000 ohms. When the electrical waves from the transmitter strike this little coherer its resistance instantly decreases, often reaching as low a point as six or seven ohms. This return to their high resistance, when the local circuit is instantly opened, and the telegraph sounder gives its up click, or if a bell is used it instantly ceases to ring. Mr. Clarke's exhibit is so well adjusted that a large six-inch vibrating bell placed in the case containing the receiver is continually ringing out the Morse signals "N. Y.," "N. Y.," "N. Y.," and attracting universal attention by its wonderful performance. There is no material connection whatever between the transmitter and the receiver. In fact the electric waves do not seem to be interrupted in the least by the iron pipes which are used for the fountain in the center of the Garden, or by the large crowds of people which continually surround the apparatus. In order, however, that this perfect working can be secured it is necessary to connect one side of the receiver and one side of the transmitter to the earth, the other side of each of these instruments being connected to a brass rod about 10 feet in length which is hung from insulated supports, and which does not touch any conductor in any way whatever.

Mr. Clarke states that the apparatus has reached such a high state of perfection, that he is ready to transmit a message between New York and Chicago at any time when he receives an order for the necessary outfit. In doing this, however, it will be necessary to have an instrument in every town upon the way, and these instruments would respond to the signals sent out by the operator at any one of them in the same way as an ordinary telegraph.

The system promises to be of value to the American army and navy, and they are already placing orders with Mr. Clarke for his apparatus, which is so designed and constructed for this particular use that its method of operation is only known to those using it.

In the center of the Garden is placed a large tank of water, and in this tank four times each day Mr. Clarke blows up a miniature warship, which is blown into splinters by the mere pressing of a button on the transmitter in the south gallery, no connection whatever being made between the transmitter and the tank. A coherer however, is placed at the edge of the tank connected with a short wire running upward into the air.

NEW YORK ELECTRICAL EXHIBITION.—LOOKING EAST FROM MAIN ENTRANCE.

enormous decrease in resistance allows the current from the single cell of dry battery to pass through the magnet coils of a telegraph relay which is placed in circuit with the coherer. The relay magnets by their magnetism then pull up the armature, and this armature in its turn makes an electric contact which closes the local circuit of the apparatus, and clicks an ordinary telegraph sounder, rings a large vibrating bell, fires a cannon or mine, starts or stops a steam engine, or does anything that can be accomplished by a slight current of electricity.

When the waves have acted upon the powder in the tube it still remains at its low resistance point, and therefore it would be impossible to send more than one signal, were it not for the fact that at the same time that the relay armature closes the local circuit it also throws a strong battery current through a pair of magnets which operate a vibrating hammer. This hammer continually vibrates against the glass tube as long as the local circuit is closed. The tappings of these vibrations against the tube tend to shake up the powder, and cause it to return to its former high resistance, but as long as the waves are coming in from the transmitter, the filings are not perceptibly affected by the tappings. The instant, however, that the waves cease coming, the tapping shakes up the filings, and they immediately

Some of the Exhibits.

The Silex Insulation company of New York shows a new wiring conduits, which are administratively described as insulated, indestructible and incombustible.

A. W. Koenig is in charge of the Faries Manufacturing company's exhibit.

The John A. Roebling's Sons company shows all kinds of wires and cables, and the gentlemen in attendance at the exhibit receive their friends in a handsomely furnished parlor.

The Adams-Bagnall Electric company of Cleveland has a full line of arc lamps for all voltages and current, both in plain and ornamental finish. C. W. Phipps, the eastern manager of the company, spends much time at the exhibition.

A fine display of the MacIntire arc lamps is made by the International Arc Lamp company. One very striking feature is a pendant of 37 lamps in the center of the building. The lamps in this "arcolier" are lighted simultaneously by one service switch. They aggregate 40,000 candle power and weigh 1,500 pounds. Other lamps attract attention in various booths and about the building. Several of the booths of the electrical journals contain the MacIntire lamps.

The booth of the International Correspondence Schools of Scranton is very attractive. A picture of the school buildings, five by seven feet in size, surrounded by electric lights, showing the picture off to great advantage, hangs at the back of the booth. All engineers and electricians attending the exhibition who desire to obtain a technical education in engineering or electricity will find it interesting to visit this booth.

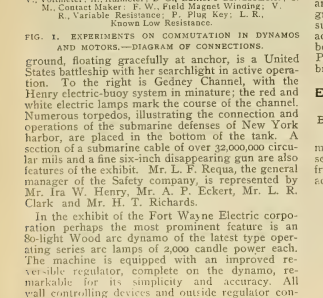
A beautifully dressed figure of the Goddess of Liberty is an attractive object in the booth of J. Jones & Son of New York. The rear wall of the booth is occupied by a handsome exhibition board, which displays a sign in miniature lamps, with switches, brackets, etc. Telephone bells and circuit breakers are shown on panel boards, and the exhibit also includes a switchboard complete. Other supplies and heating apparatus are displayed on counters. A neon arc lamp is shown in connection with a clock, which automatically turns the current on and off at set times.

The National Carbon company's exhibit is in charge of Richard O'Connor and M. H. Mead. It shows a complete line of carbon products, such as

which can be seen all sizes and shapes of telephone transmitter parts. In this line are shown carbon diaphragms as thin as .008 of an inch. A full line of all the battery cells manufactured by this company is shown, and its special gas-engine cell is exhibited for the first time. All sizes of round carbons, from one-eighth inch diameter up to six inches (the latter being the largest round carbons ever exhibited), are shown. Attention is called to the great facilities of this company for producing carbon of all kinds for experimental work. Several members of the company expect to be on hand at times during the show to renew acquaintance with their electrical friends.

H. B. Coho & Co. represent among other concerns at the exposition the Eddy Electric Manufacturing company and the Warren Electric Manufacturing company. They have in operation a 75-kilowatt improved Warren alternator, working 1,100 and 100 volts off the same machine, run by an Eddy direct-current motor. They also represent the American Rheostat company, Milwaukee, Wis.; Crown Woven Wire Brush company, Salem, Mass.; Diamond Electric company, Peoria, Ill.; Van Horne, Burger & Co., Dayton, O.; Translucent Fabric company, Quincy, Mass.; Otis Electric company, New York; Marietta Manufacturing company, Marietta, Pa., and the Pennsylvania Electric company, Philadelphia. In addition to the above companies, they exhibit a full line of switchboards, panel boards, etc. The exhibit is under the management of T. W. Kloman.

The exhibit of the Safety Insulated Wire and Cable company is one of the most novel at the electric show. The center of this space is occupied by a large tank showing "A Night Scene off Sandy Hook," with the use of Safety cables. The background is a painting of the numerous government works, showing Fort Hancock and the light-houses. In the fore-



V., Voltmeter; A., Ammeter; B. G., Ballistic Galvanometer; C. M., Contact Maker; F. W., Field Magnet Winding; V. R., Variable Resistance; P., Plug Key; L. R., Known Low Resistance.

FIG. 1. EXPERIMENTS ON COMMUTATION IN DYNAMOS AND MOTORS.—DIAGRAM OF CONNECTIONS.

ground, floating gracefully at anchor, is a United States battleship with her searchlight in active operation. To the right is Gedney Channel, with the Henry electric-buoy system in minature; the red and white electric lamps mark the course of the channel. Numerous torpedos, illustrating the connection and operations of the submarine defenses of New York harbor, are placed in the bottom of the tank. A section of a submarine cable of over 32,000,000 circular mils and a fine six-inch disappearing gun are also features of the exhibit. Mr. L. F. Requa, the general manager of the Safety company, is represented by Mr. Ira W. Henry, Mr. A. P. Eckert, Mr. L. R. Clark and Mr. H. T. Richards.

In the exhibit of the Fort Wayne Electric corporation perhaps the most prominent feature is an 80-light Wood arc dynamo of the latest type operating series arc lamps of 2,000 candle power each. The machine is equipped with an improved reversible regulator, complete on the dynamo, remarkable for its simplicity and accuracy. All wall controlling devices and outside regulator connections are dispensed with. This dynamo is driven by a direct-connected multipolar motor. A 37½-kilowatt Wood alternator of the low-frequency type is operated by a direct-current motor and supplies current to alternating-current arc lamps. There is also a five horse power single-phase, synchronous, alternating-current motor capable of starting under full load from a single-phase circuit, without the introduction of phase-splitting coils, condensers or other complicated auxiliaries. A commutator truing device, which is shown, is a simple tool, operated by hand, for facing the commutator perfectly true with the bearings. Small motors, transformers, meters and switchboard panels complete the exhibit, which is in charge of F. A. Wunder, assisted by T. A. Nathans.

Burhorn & Granger of New York and Philadelphia are exhibiting in operation a nine by 12-inch Woodbury high speed engine direct-connected to a 25-kilowatt Eddy generator. This engine is of the latest improved type and is equipped with the Shepherd governor, with which a regulation of one half of one per cent. for all variations of load is guaranteed, and also with an automatic oiling system to which the exhibitors invite attention. The regulation can be tested by visitors with the aid of a recording tachometer at the exhibit. Another portion of the space is taken up by a sectional model of the Woodbury cylinder and steam chest showing the Woodbury valve, the method of adjustment and means of providing for entrained water. This portion of the exhibit proves very interesting to visitors, who are thus enabled to see the inside of an engine of the same size and type as the one in operation. Attention is called to Burhorn & Granger's exhibit by a revolving illuminated sign. The firm distributes an attractive souvenir card on which announcement is made of the various houses which it represents, including the Stearns Manufacturing company of Erie, Pa., Harrisburg Manu-

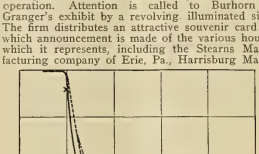


FIG. 2. EXPERIMENTS ON COMMUTATION IN DYNAMOS AND MOTORS.

facturing and Boiler company of Harrisburg, Pa., Philadelphia Engineering Works, Philadelphia Pa., and the Union Iron Works, Erie, Pa.

The Partridge Carbon company of Sandusky, O., is represented by Mr. Partridge himself, who presents to the general trade for the first time his new electric-light carbon for enclosed arcs, which the company claims to be equal to, if not better than, the imported carbons now in the market. Mr. Partridge had a number placed in several of the different enclosed-arc lamps. Tests were made on a Nowotny lamp at 110 volts and 4½ amperes and on one of 220 volts and 2½ amperes, and from all accounts the results were a great surprise to the enclosed-arc lamp people, as they claim it has been heretofore impossible to procure an American-made carbon suitable for this trying service. It is interesting to state, too, that a representative of the Western Electrician recently witnessed a test of these carbons under Manager Speer of the Partridge company at the Soldiers' Home in Sandusky, and the results were certainly such as would warrant an investigation of the merits of these new carbons of the Partridge company by electric-light men of this country interested in finding an American-made carbon suitable for enclosed-arc lamp service. Mr. Partridge received many congratulations on his success at having accomplished such fine results after his two years of hard work. In addition to exhibiting this special electric-light carbon, Mr. Partridge made a display of the well-known Partridge self-lubricating motor and generator brushes.

Experiments on Commutation in Dynamos and Motors.[1]

By W. H. Everett, B. A., B. E., and A. H. Peake.

The theory of commutation in dynamos and motors has been treated by various writers, but there seems to be room for further verification and help from experiment. We therefore give here a short account of some work in this field, on which we have

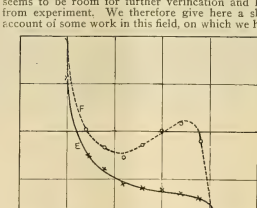


FIG. 3. EXPERIMENTS ON COMMUTATION IN DYNAMOS AND MOTORS.

from time to time been engaged. The experiments have been carried out in the electrotechnical laboratory of University College, Nottingham, where Prof. W. Robinson has kindly afforded us every facility.

Our work so far has been confined to a Crompton two-pole, compound-wound dynamo, with ring armature, designed to give up to 45 amperes at 110 volts when running at 1,610 revolutions per minute. It has 60 sections in the armature winding, each of six turns of wire 0.09 inch in diameter; the commutator segments being 7-32 inch thick on the face, and separated by 1-32 inch of mica. The resistance from brush to brush is 0.12 ohm, or 0.008 per section. The overall diameter of the armature is 7⅝ inches, and the net cross-section for the magnetic flux is 12 square inches. Throughout these experiments separate excitation, generally at about 100 volts, has been employed, without the series winding.

Referring to any direct-current dynamo or motor, the current is reversed in each section while passing under either brush, and thus the curve connecting current and time, for a given coil, consists practically of a straight line above and parallel to the time axis, followed by a straight line at the same distance below. The current cannot change abruptly, and hence these two straight lines must be joined by a curve, giving the current in the coil at each instant while it is passing under the brush. It is to this curve that we have given most attention.

Passing over various pioneer experiments, it will be enough to describe the arrangement we are now using (Fig. 1). We employ a special split brush, consisting of two copper plates, 0.036 inch thick and 1.6 inches wide, separated by vulcanized fiber, the overall thickness being about equal to that of the face of a segment. These plates are joined by a non-inductive resistance of 0.007 ohm, to the middle of which the positive main is connected. The negative brush is an ordinary one, covering about one segment and a quarter. From the ends of the resistance wires are brought to the terminals of a condenser, and in this circuit is included a revolving contact-maker, which completes the circuit at any desired instant in every revolution of the armature. The condenser is thus charged to the voltage existing between the ends of the resistance for any selected position of the armature coil under the brush; and this voltage is found by discharging the

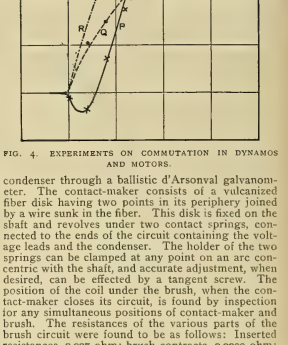


FIG. 4. EXPERIMENTS ON COMMUTATION IN DYNAMOS AND MOTORS.

condenser through a ballistic d'Arsonval galvanometer. The contact-maker consists of a vulcanized fiber disk having two points in its periphery joined by a wire sunk in the fiber. This disk is fixed on the shaft and revolves under two contact springs, connected to the ends of the circuit containing the voltage leads and the condenser. The holder of the two springs can be clamped at any point on an arc concentric with the shaft, and accurate adjustment, when desired, can be effected by a tangent screw. The position of the coil under the brush, when the contact-maker closes its circuit, is found by inspection or any simultaneous positions of contact-maker and brush. The resistances of the various parts of the brush circuit were found to be as follows: Inserted resistances, 0.007 ohm; brush contracts, 0.0022 ohm; armature section, 0.0088 ohm; total, 0.0174 ohm. These tests were made with a current of 15 to 20 amperes. The total with the ordinary brush was about 0.0088 ohm, or say half of the other.

It is necessary to consider the effects, on the commutation current-curve, of the modifications present in our split brush. Any features due to contact resistance of the brush should be known nearly unaltered in our curve, for such resistance is mainly operative only when a segment is just coming under the heel of the brush or just leaving the toe, and the middle part of an ordinary brush is therefore, in this respect, comparatively idle. The diminished thickness of the brush probably has the effect of slightly smoothing down the first and last parts of the curve, since it diminishes the range of commutation. As regards the insertion of resistance in the brush, one effect of this is to decrease the time constant, thus making the slopes in our curves, on the whole, steeper; but in any case, so far as this point is concerned, the curves hold good for a similar armature wound with wire of half the present gauge.

The general character of the curves admits of a simple explanation and agrees with the predictions of Mr. Housmann in his suggestive remarks on W. B. Sayers' first paper (Journal of Institution of Electrical Engineers, 1893, p. 490). In a motor, as a coil approaches the neutral axis, the electromotive force is in such a direction as to oppose the current—that

1. From the London Electrician.

is, to aid its reversal; and when the coil has passed the neutral axis, the electromotive force tends to oppose reversal. Hence to obtain reversal the brush should be moved to such a position as will bring the neutral point near the toe. It follows that the slope of the curve is greatest at first, and afterward decreases. In a dynamo the field required for reversal (since the current is in the opposite direction to that in a motor) lies in front of the neutral axis, and consequently the neutral point should be near the heel. This will give curves of the character shown. It should be remembered that the neutral axis is not fixed, but tends to move with the brushes if the lead is altered, though not to the same extent. Whatever current there is in the coil just before leaving the brush must be altered to half the armature current by the increase of contact resistance between brush and segment. Any excessive inaccuracy of finish will give rise to sparking.

Since at the neutral point no electromotive force is acting in the short-circuited coil, the current must there be diminishing, for an instant, at a rate—

$$\frac{di}{dt} = -\frac{R}{L}i,$$

where R is the resistance in the coil circuit and L is the inductance. Inserting approximate values for R and L, the neutral point can be found by inspection in each case. Generally it is near a horizontal part of the curve.

The curves shown in Figs. 2, 3 and 4 are each the average of four or five taken in succession, the average being taken as follows: Each individual curve was drawn rigidly through the points found; eight equidistant points were then taken in each curve, and the averages of the respective ordinates taken and plotted to give the curve shown. The scale in each case is so chosen that half the armature current is represented by the same ordinate. The brushes were always adjusted to avoid sparking. Figs. 2 and 3 show commutation curves for the machine used as a motor. The three curves in Fig. 2 show the effect of varying the current only; the brush position, speed and excitation being kept constant. As the current is increased the curves become flatter, and the first drop is not so great. This is what would be expected. Curve E in Fig. 3, compared with curve B in Fig. 2, shows more gradual reversal of the current due to weaker field. Curve F in Fig. 3, compared with curve B in Fig. 2, shows the result of moving the brush forward by half a segment. The first drop in the curve is not so great; the rise begins earlier and a greater change in the current has to be produced by the increase of contact resistance as the segment leaves the brush. Although this change is about 10 amperes, only very slight blue sparks were noticeable at the toe of the brush, showing that the current must have been raised almost to the half armature current before the circuit was broken.

It was found that a large change in the speed had little effect on the curves.

In Fig. 4 are shown three representative commutation curves for the machine driven as a dynamo. Curve P shows the increase of current at first, which is obtainable at light loads, and also excessive reversal. Curve R shows the gradual falling off in the rate of reversal as the current approaches the value demanded by the electromotive force. It also shows a change of current produced by contact resistance. This change must have been complete, for no appreciable sparking was produced; in fact, the experimental brush stood the heavy current of 45 amperes quite as well as the other brush.

COLLECTED DATA FOR THE CURVES

Curve	Armature current	Voltage on field.	Revs. per min.
A	6 5	100	420
B	12 0	100	430
C	17 5	100	600
E	19 0	50	650
F	12 0	100	440
P	6 6	100	820
Q	11 0	100	470
R	45 0	100	820

With a field excitation of 43 volts, a speed of 760 revolutions per minute and an output of 20 amperes, a curve was obtained very similar to curve R. This excitation gives about 45 per cent. of the flux with 100 volts. The reciprocal of the speed, since there are 60 commutator segments, is the fraction of a second in which the commutation is effected, and this is represented by the abscissa of the curve.

We hope to examine the subject of commutation further, as time permits. Instead of our present brush, we think of using a triple brush having three resistances meeting at a point; this, though not so simple, would remove the restriction as to brush thickness. Again, it would be instructive to find commutation electromotive force curves, say by means of thin coils over the armature winding, using instantaneous contact. Experiments with the machine used as a rotary transformer (for which purpose six slip rings are already fitted) would likewise be of interest. And we hope also to study commutation in a machine with toothed armature core.

W. A. Seevers has sold his interests in the electric-light and street-railway plant at Muscatine, Ia., to Harry W. Huttig.

Regulation of Compound-wound Dynamos.

The action of the Edison Electric Light company against the E. G. Bernard company and others has been decided in favor of the defendants and the bill dismissed. The action was instituted by the General Electric company and was defended by the Siemens & Halske company. It was based upon the patent, No. 264,668, granted to Thomas A. Edison, September 19, 1882, for an improvement in regulating the generative capacity of dynamo-electric machines. The defense in this suit was the invention and patent of Brush, which preceded any work of Edison on commercial dynamos, and which the court has found anticipated the Edison patent. The opinion of the court which accompanies this decision is of great importance to all manufacturers of dynamo-electric machinery. It has been maintained by those interested that if the Edison patent had been sustained, it would have subordinated practically all the generators for electric-railway and direct-current electric-lighting work in the United States.

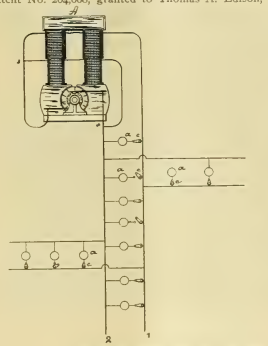
The cuts which accompany this article and to which reference is made in the opinion are reproduced from the specifications, one from the Edison patent and the group of five diagrams from the Brush patent.

The opinion is here presented in its entirety, as it forms an important and interesting chapter in the history of American electrical invention.

UNITED STATES CIRCUIT COURT,
Northern District of New York.

Edison Electric Light Company vs. E. G. Bernard Company *et al.* } Final hearing. In equity

This is an equity action, founded upon letters patent No. 264,668, granted to Thomas A. Edison,



REGULATION OF COMPOUND-WOUND DYNAMOS EDISON PATENT, NO 264,668.

September 19, 1882, for an improvement in regulating the generative capacity of dynamo-electric machines. The specification says:

The object of this invention is to produce means by which the addition or removal of translating devices in the multiple-arc circuits of a system of electrical distribution shall cause immediately a proper regulation of the current energizing the field magnet of the dynamo electric machine supplying such system, and this without the use of adjustable resistances, or of any mechanism whatever, except the ordinary circuit controllers of the lamps.

Of the drawing the specification says:

A is a dynamo-electric machine, from which lead the main conductors 1 2, in multiple-arc circuits from which are placed lamps or other translating devices, a, each provided with a circuit controller c. The lower portion of the field-magnet of the generator A is wound with wire, forming part of the multiple-arc circuit 3 4, from the main conductors 1 2. This circuit is of high resistance, so that only a small amount of current sufficient to primarily energize the field magnet will pass through it. It may, if desired, be a circuit supplied from an external source instead of from the conductors 1 2. The main conductor 1 is brought up on one side and wound around the magnet, afterward extending out parallel with the conductor 2 When translating devices are first put in circuit the magnet is sufficiently energized by means of the circuit 3 4, but as their number is increased the resistance of the main circuit is lowered, so that more current flows through the conductor 1 and the magnet becomes more and more energized. As devices are thrown out and the resistance of the main circuit increases, the energy of the magnet is lessened by the decrease of current in the conductor 1.

It will thus be seen that the regulation of the machine is accomplished instantly and automatically by the throwing in and out of circuit of single translating devices, the addition or removal of each device having an immediate effect on the current passing through the field magnet.

The claims are:

1. The combination, with a dynamo-electric machine and translating devices arranged in multiple arc, of a field circuit of constant resistance for primarily energizing the field magnet, and another field circuit whose resistance is varied by the addition and removal of translating devices, substantially as set forth.

2. The combination, with a dynamo-electric machine of one of its main conductors forming a portion of the coils of its field magnet, a circuit for primarily energizing such field magnet and translating devices arranged in multiple arc or derived circuits, whereby the addition of each individual translating device causes a corresponding increase in the energy of the field magnet, substantially as set forth

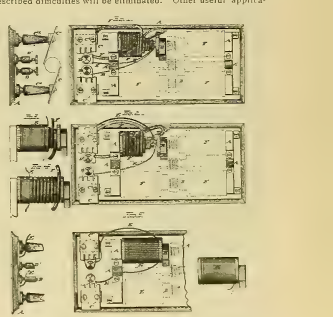
3. The combination of a multiple-arc circuit containing a portion of the coils of the field magnet of a dynamo-electric machine, a multiple-arc circuit containing the armature of said machine, and multiple-arc circuits containing lamps or other translating devices, all such multiple-arc circuits being derived from the same main conductors, and another field circuit whose resistance is varied by the addition and removal of translating devices, whereby the addition or removal of any translating device causes an instant and corresponding regulation of the current energizing the field magnet of the machine, substantially as set forth.

The earliest date assigned for the conception of the Edison invention is August 19, 1879. The machines made at the time of the patent, and prior thereto, did not operate in a satisfactory manner. They never were a commercial success. They have disappeared.

On the 22d of July, 1879, letters patent, No. 217,677, were granted to Charles F. Brush for an improvement in dynamo-electric machines. The application for this patent was filed March 11, 1878. Brush says in the specification:

My invention relates to dynamo-electric machines, and has for its object the maintenance in such machines of a "magnetic field" while the machine is running, whether the external circuit is closed or open.

In dynamo-electric machines as ordinarily constructed no magnetic field is maintained when the external circuit is open, except that due to residual magnetism; hence the electromotive force developed by the machine in the condition is very feeble. It is only when the external circuit is closed through a resistance not too large that powerful currents are developed, owing to the strong magnetic field produced by the circulation of the currents themselves around the field magnets. Such machines are not well adapted to certain kinds of work, notably that of electroplating. For this purpose a machine arranged to do a large quantity of work at one operation may fail entirely to do a small quantity, because of the comparatively high external resistance involved in the latter case and the low electromotive force of the machine at the start. Again, it is well known that during the process of electroplating, a very considerable electromotive force is developed in the plating bath in a direction opposed to the current from the dynamo-electric machine. If now the current from the machine is momentarily weakened, by accident or otherwise, its magnetic field, and consequently its electromotive force, are correspondingly reduced. If the latter falls below the opposing electromotive force of the bath, it will be overcome by it, and the machine will have the direction of its current reversed. This accident often happens with plating machines, and is a source of much annoyance. It will now be obvious that if even a moderately strong magnetic field be constantly maintained within the machine, both of the above described difficulties will be eliminated. Other useful applications of a "permanent field" machine will readily suggest themselves.



REGULATION OF COMPOUND-WOUND DYNAMOS — BRUSH PATENT, NO 217,677.

I attain my object by diverting from external work a portion of the current of the machine, and using it, either alone or in connection with the rest of the current, for working the field magnets. I prefer the latter plan of the two just above mentioned, especially for electroplating machines. If, now, the external circuit be broken entirely, the magnetic field will in the former plan just mentioned remain unimpaired, and in the latter plan will remain sufficiently strong to effect the desired end

In applying my invention to dynamo-electric machines, I wind the cores of the field magnets with a suitable quantity of comparatively fine wire having a high resistance in comparison with that of the external circuit and the rest of the wire on the machine. The ends of this wire are so connected with other parts of the machine that when the latter is running a current of electricity constantly circulates in said wire, whether the external circuit be closed or not. The high resistance of this wire prevents the passage through it of more than a small proportion of the whole current capable of being evolved by the machine therefore the available external current is not materially lessened When this device, which I have called a "teaser" is used in connection with field magnets, also wound with coarse wire, as shown in Fig. 1 of the drawings, for the purpose of still further increasing the magnetic field by employing the main current for this purpose, in the usual manner, then the teaser may be so arranged that the current which passes through it will also circulate in the coarse wire, thus increasing the efficiency of the device This arrangement, illustrating one of the [illegible] applications of my inventions is shown in Fig 1 of the drawings.

Instead of the teaser and helix I being constructed from wire of different gauges, the size of wire may be alike in both [illegible] the teaser wire may be coarser than the principal magnet wire but in these cases the waste of current through the teaser would be excessive, leaving comparatively little for use in the external circuit.

Instead of the magnet being surrounded with both teaser and ordinary helix I, the latter may be omitted, and the teaser increased in gauge and length thus still maintaining its high resistance until it will of itself maintain sufficient magnetic field This modified form of machine is shown in Fig [illegible] of the drawings.

After explaining the drawings he says:

It should be distinctly understood that I do not limit my invention to the form adaptable to any particular dynamo-electric machine [illegible] susceptible of a variety of modifications whereby it may be applied to devices of various constructions without any material departure from the spirit and intent of the essential principle of its construction and operation

[Continued on page 2[illegible].]

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American manufacturers have established their reputation in England, and they are now engaged in pushing their wares in Germany with the same vigor that marked their course in Great Britain. The facilities of the American manufacturers as compared with foreign companies are illustrated in the following cablegram from Berlin: "Twenty American electric street cars were recently delivered in Berlin and 100 more have been ordered. They were wanted quickly, and therefore the order was placed with an American firm that was able to deliver them in Berlin at the same price and in about one-fourth of the time required by German manufacturers." Wherever enterprise and good workmanship are prized American products are bound to win.

In view of the recent interruptions of the cable service and the present interest in everything pertaining to international telegraphy, it is worthy of note that "the Spanish government issued just before the war a decree which gives certain privileges to Spanish and foreign vessels as long as they are used exclusively for the purpose of cable-laying or maintenance, and provided that they do not carry any cargo other than cables and apparatus necessary for their work. These vessels are practically made free of custom dues. All that is required is a statement signed by the captain showing the occupation of the vessel and the stores on board. The Spanish authorities are enjoined to give every assistance in their power to further the work of these vessels." The attitude of Spain toward submarine cable enterprises has not been uniformly friendly in the past.

In view of the hostile attitude of the daily newspapers of Chicago and a considerable portion of the community to the policy of the street-railway companies, it is said that these corporations are seriously considering the advisability of establishing a mail and express route from Whiting, Ind., to Evanston, Ill., in order to place their properties beyond the control of the city council. It is proposed to lease the lines of the South, West and North divisions of the city to the Chicago General Railway company, which is incorporated, not under the "horse and dummy" act, as are the other roads, but under the "steam railroads" act. The same rights are claimed for the Chicago General as are enjoyed by the Northwestern and other roads using city streets. After a mail service is put in operation it is claimed all the lines over which the cars run will become post routes and pass under federal jurisdiction. Any attempt on the part of the city to take possession or tear up the tracks on the expiration of the franchises, according to the projectors, will incur liability to prosecution in the federal courts. Another reason for running cars from Whiting to Evanston is to give the route terminals in two states, bringing it, if possible, within the jurisdiction of the Interstate Commerce Commission. The right to lease other lines is granted to the West and South Towns railway, which is a part of the Chicago General system. It is proposed to carry only mail and packages on the through cars, thereby obviating competition between the several lines.

Not long ago a spirited discussion in Congress attracted the attention of the country to a number of prominent industrial enterprises, including several electrical companies, that were said to enjoy special privileges through legislative and governmental concessions. These corporations were denounced as monopolistic institutions and they were charged with exerting a pernicious influence at Washington. Probably as a result of this stirring up, Senator Cannon has introduced a resolution for the appointment of a Senate investigating committee, consisting of the present committee on manufactures, to find out and report to the Senate whether there are combinations or trusts in manufacturing circles in the United States, whether they are fostered by the existing tariff law, whether they are to the public advantage, whether their character is such as to bring them within the scope of the prohibitory laws, and, if so, why they are not prosecuted and dissolved. The reasons ascribed for introducing this resolution are that it has been publicly charged that certain manufacturers of the United States who are engaged in interstate commerce have entered into combinations to control the manufacture and sale of certain articles of general consumption, and that they are protected by law against competition from foreign manufacturers. The contention is made by the advocates of these trusts that their effect is to cheapen the cost of manufacturing, and, as a result, to cheapen the cost of such manufacture to the people. It is not probable that action will be taken on a resolution of this character at the present time, but it is significant of the general attitude of the people toward combinations.

In England the National Telephone company occupies a position somewhat similar to that enjoyed by the American Bell Telephone company in this country for many years. It virtually controls the telephone business of the country, and, like all corporations of the kind, it has many enemies who are actively engaged in opposing the granting of additional privileges or the perpetuation of present conditions. The company is now under fire, and a parliamentary investigation of the conditions of the service is expected. A comprehensive report of the recent discussion on this subject in the House of Commons was printed in the Western Electrician on April 23d. It showed that there had been much objection and complaint, resulting in a public demand for the acquisition of this business by the government as a branch of the Postoffice Department.

The statement of the company's position, made by its representatives at the annual dinner of the staff of the corporation, will be read with interest in this connection. It was announced that during the last year 90 new exchanges had been opened, making a total of 800 in working order, and the number of subscribers had increased by 12,000. The company courted the fullest inquiry, and it was believed that the judgment of experts would be that the service was as cheap and as efficient as it was possible to make it, considering the great difficulties with which the company had to contend. It was admitted that the great municipalities had recognized the commercial advantages of this means of communication and had enabled the company to make great strides in placing wires underground, and bringing the plant into efficient condition. The familiar claim was made that where facilities have been afforded the National telephone service compares favorably with that in any part of the world. Comparing the telegraph and telephone services it was pointed out that by means of the latter, 430,000,000 of effective messages were sent last year, while the telegraph system sent 73,000,000. The comparison with the work of other countries was even more favorable. Germany, with a population of 52,000,000, had 107,000 subscribers; while England, with a population of between 38,000,000 and 39,000,000, had 106,000 subscribers; that is, there was one subscriber in every 300; in Germany, 1 in 400; in France, where there were 30,000 subscribers, 1 in 1,200; in Austria, 1 in 1,500; in Belgium, 1 in 680, and in Holland 1 in 1,000.

Like the Bell company in this country, the National company in England is clamoring for exclusive privileges. It abhors competition and desires to be credited with assuming a philanthropic attitude in preventing capitalists from risking their money in such undesirable investments as opposition companies. The position of the National company was concisely stated by its spokesman on this occasion as follows:

Competition in this business is an impossibility. Telephony is a service which from its very nature is an imperial service and therefore a monopoly.

Those who are not under the spell of the National company in England, like those outside the circle of Bell influence in this country, will require something more substantial than such statements. The evidence of prosperity of the independent movement in this country is to be found everywhere. It may be possible that the National company fears similar development in Great Britain, and rather than enter such a contest it would welcome action by the government tending to the acquisition of its plant, especially if this could be done on the same basis as the establishment of the government telegraph system.

WAR NEWS.

Chicago Volunteers for Brigade of Engineers.—The task of forming a Brigade of Engineers, which was assumed by Captain Eugene Griffin of the General Electric company, is being pushed forward rapidly and systematically, and the assistance of many prominent workers in the electrical field has been enlisted in all parts of the country.

The Chicago Electrical association, at its last meeting, on May 6th, discussed this subject and determined to actively assist in the formation of the brigade. Lieutenant F. B. Badt explained the requirements of the service and several communications from Captain Griffin to B. E. Sunny were read. The project has been favorably indorsed by the War Department and the matter has been sent to Congress, as it is necessary to have a special bill to authorize the organization of a Brigade of Engineers "from the nation at large." The Senate has passed such a bill and the House probably will take similar action. In the meantime the secretary of war has asked Captain Griffin to raise a regiment of engineers, and it is believed that the experience gained in this way will be valuable for the larger force, and that it will be comparatively easy to expand the regiment into a brigade by building up each battalion into a separate regiment.

A committee composed of Thomas G. Grier, W. B. Hale and R. F. Schuchardt was appointed by the Chicago Electrical association to assist in the work in Chicago and vicinity.

Application blanks in the following form have been prepared for distribution among Chicago engineers, with the request that they be filled out and forwarded immediately to B. E. Sunny, Monadnock building, Chicago:

I hereby tender my services to the Government of the United States in the present war with Spain, for the term of 2 years, unless sooner discharged.

I am a ..... by trade and wish to join the Volunteer Engineering Corps in any capacity whatever.

Name: .....
Address: .....
Occupation: .....
Married or single: .....
Age: .....
Former military experience if any: .....
.....
Tropical experience if any: .....
.....
Do you speak Spanish? .....
Date: ..... 1898.

Following is a list of those who have signified their intention of entering the service in Chicago: J. W. Carroll, Charles R. Willitt, Paul M. Clemens, William Norrie, Hy. Mouronbali, Gail H. Browne, Frank C. Horn, J. C. Baird, Robert Zimbee, John J. O'Mara, John P. Leighton, George W. Ford, R. C. Huston, George Frederickson, David Angus, C. Gustafson, John M. McDougall, John J. Delaney, Fremont Hill, Timothy J. Davey, Henry J. Schell, C. W. Boynton, E. A. Mellinger, Eugene Klapp.

Many engineers throughout the Northwest have signified their intention of joining, including the following-named: Isador S. Jezewska, Winona, Minn.; G. S. Ellsworth, Madison, Wis.; P. D. Cunningham, Green Bay, Wis.; Charles L. Tindell, Dubuque, Iowa; Henry E. Elliott, Escanaba, Mich.; C. F. Burgess, Madison, Wis.; Fred J. Pratt, Champaign, Ill.; Jas. Morgan, Kansas City, Mo.; William J. Sullivan, Marengo, Ill.; V. K. Hendricks, Terre Haute, Ind.; Richard Palmer, Joliet, Ill.; H. H. Meyer, Davenport, Iowa; Clark R. Fickett, Elgin, Ill.; Thomas A. E. Cunningham, Battle Creek, Mich.; K. Ettner, South Bend, Ind.; H. L. Chipps, Champaign, Ill.; Clifford Cooling, Woodstock, Ill.; W. O. Sampson, Waukegan, Ill.; Fred A. James, S. F. Case, Milwaukee, Wis.; Thomas H. Carver, Valparaiso, Ind.

Recruiting offices have been opened in New York, Boston, Philadelphia and other eastern points, and it is anticipated that there will be no trouble whatever in securing the necessary men for the service.

Captain Griffin first broached the subject of forming an Engineers' Brigade, as noted in the Western Electrician of April 16th. In a letter to Secretary Alger Captain Griffin suggested that a volunteer Brigade of Engineers, not exceeding 3,500 men, be regularly enlisted and commissioned in the service of the United States, to consist of three regiments, each organized as follows: one colonel, one lieutenant-colonel, three majors, one lieutenant and adjutant, one lieutenant and quartermaster, six lieutenants, adjutants and quartermasters of the three battalions, one sergeant major, one quartermaster sergeant, 12 companies, A to M inclusive, 91 men each; total, 1,131.

Each regiment is to be composed of civil and mechanical engineers, electrical engineers, and practical electricians, mechanics, artisans, draughtsmen, and men familiar with all kinds of engineering work, capable of being rapidly converted into military engineers with proper training.

He pointed out that in the contemplated occupation of Cuba, the character of the country and the probability of siege operations against Havana make it obvious that an unusually large proportion of engineer troops will be required.

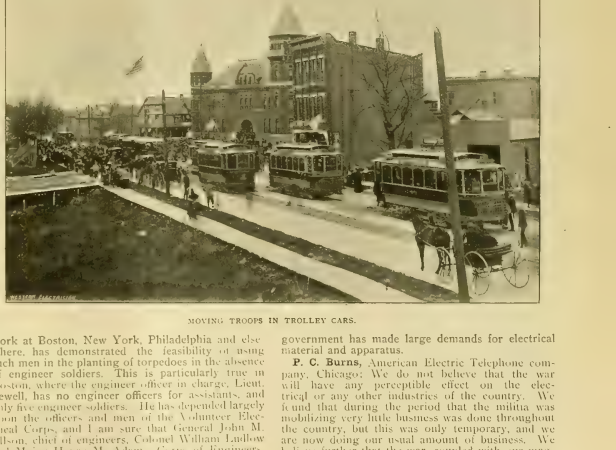
Modern warfare will involve the use of electricity in many ways. Movable electric generating plants will be used extensively both for both offensive and defensive night work, for lighting permanent camps, for the operation of pumps, hoists, drills, etc., in siege operations, and, in fact, under all conditions. Movable searchlight outfits will be in demand on the battlefield to search for the wounded, and Röntgen-ray outfits in field and permanent hospitals, and in many other ways not yet contemplated.

Photography will play an important part in reconnaissance work and no field topographical map will be regarded as complete without supplementary photographs showing the appearance of the ground occupied or to be occupied by troops, or over which projected movements are to be conducted.

Civil engineers capable of building and destroying bridges, tunnels, railway tracks, etc.; mechanical engineers, able to construct, operate, repair or destroy machines and mechanical appliances, such as locomotives, stationary engines, etc., and military engineers capable of laying out and constructing hasty entrenchments and field fortifications and carrying out the complicated work of siege operations will be in great demand.

The regular battalion of engineers of only 500 men, even it expanded to a war footing of 750 men, is entirely inadequate for such work, and, moreover, considerable numbers are now detached on torpedo work in connection with coast defenses.

Of the work already done Captain Griffin says: "The Volunteer Electrical Corps, raised from the employes of the electrical companies, which has been assisting the regular engineer officers in torpedo



MOVING TROOPS IN TROLLEY CARS.

work at Boston, New York, Philadelphia and elsewhere, has demonstrated the feasibility of using such men in the planting of torpedoes in the absence of engineer soldiers. This is particularly true in Boston, where the engineer officer in charge, Lieut. Sewell, has no engineer officers for assistants, and only five engineer soldiers. He has depended largely upon the officers and men of the Volunteer Electrical Corps, and I am sure that General John M. Wilson, chief of engineers, Colonel William Ludlow and Major Henry M. Adams, Corps of Engineers, and other officers familiar with the facts, will testify that the work done by the Volunteer Electrical Corps has been entirely satisfactory."

Detachments from the proposed Volunteer Brigade, it is pointed out, could, if it be deemed best, relieve nearly all of the regular engineer soldiers and many of the engineer officers from their present torpedo duty, and leave the regular battalion of Engineers free for service with the rest of the regular army. Such detachments are also capable of installing and maintaining all electrical appliances used in connection with coast defenses.

Moving Troops in Trolley Cars.—Reports from all parts of the country tell that the trolley has played the movement of the regular army and the national guard to their camps, aiding materially in the quickness of the movements. The correspondent of the Western Electrician at Niagara Falls furnishes the photograph from which the accompanying picture was made, and relates the following narrative: "In Niagara Falls Superintendent John C. Brewster, of the Niagara Falls and Suspension Bridge Street Railway company, placed the facilities of his line at the disposal of the Forty-second Separate Company in order that the company might go to the north end of the city and march to the south end, thus giving all the people an opportunity to see the company on its departure for the camp at Hempstead Plains, L. I. The illustration shows the crew in

[Continued on page 287.]

WAR OPINIONS.

S. D. Greene, General Electric company, Schenectady, N. Y.: It seems to me that the present war must necessarily check new electrical enterprises (where capital is to be raised) just as it will check new enterprises in other fields. Apart from this, it seems to me that the ordinary business of existing companies for light or power will continue very much the same as at present, although there will probably be a general inclination among consumers of light and power to economize in this as well as in other directions. The government will undoubtedly make large demands for electrical apparatus for military purposes, but such business is necessarily a small fraction of the total business of the country. We all unite, I fancy, in hoping that the war may be of short duration, and I think it is the duty of all good citizens of the country to do what they can to bring this conflict to the earliest possible close and with the greatest possible credit to the country.

E. H. McFall, National Automatic Fire-alarm company of Louisiana, New Orleans: As to the probable effect of war on the electrical industries of this country, we can only judge from present indications, which go to show that the electrical industries of the country will not suffer in the least from the Spanish-American trouble. Should there be an early termination of the war, which the present conditions indicate, I believe that the electrical industries will be benefited, owing to the fact that the government has made large demands for electrical material and apparatus.

P. C. Burns, American Electric Telephone company, Chicago: We do not believe that the war will have any perceptible effect on the electrical or any other industries of the country. We found that during the period that the militia was mobilizing very little business was done throughout the country, but this was only temporary, and we are now doing our usual amount of business. We believe further that the war, coupled with our magnificent victories, will advertise our country in foreign markets, with the result that foreign markets will be opened up for all lines of American goods.

F. W. Ferguson, Walker company, Cleveland: It is an admitted fact that national disturbances reflect directly upon general business conditions, and capital, which is always sensitive, is particularly so in times of hostilities. Therefore it would appear that new electrical street railway enterprises may be temporarily curtailed or postponed; but the demand for indispensable requirements necessary to meet the summer traffic and the development in electric lighting and power plants is exceptionally large and not likely to be seriously interrupted except by a war of long duration. But even in that event the resources of the United States are so diversified and comprehensive that I do not anticipate any material setback to the steady progress which is being made in the electrical business. Our plant factory and bound-ary so well equipped for the manufacture of large machinery and mammoth castings that we are at present running night and day on special work, exclusive of our electrical business. The United States government has taken advantage of our extensive facilities by awarding the Walker company urgency orders for a large number of disappearing gun carriages, to be used for coast defenses, and this work may necessitate considerable improvements and additions to our factory.

[Continued on page 286.]

DEVELOPMENT OF THE TELEPHONE FIELD.

Intermediate Switchboards for Series Toll Lines.

By H. P. Clausen.

Whenever two or more toll-line circuits meet at a centrally located point, the necessity arises for providing means for interconnecting the different branches; in other words, a toll switchboard must be installed. Viewed from a technical point, it is a simple proposition to supply the proper switching appliances for interconnecting toll lines; practically, however, it is found that most toll switchboards must necessarily be operated by inexperienced people, who are apt to create confusion and much loss of time

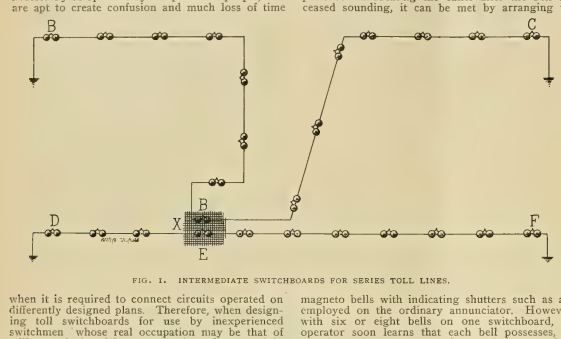


FIG. 1. INTERMEDIATE SWITCHBOARDS FOR SERIES TOLL LINES.

when it is required to connect circuits operated on differently designed plans. Therefore, when designing toll switchboards for use by inexperienced switchmen whose real occupation may be that of selling agricultural instruments drop theory and in its place employ sound judgment gained by a critical observation of apparatus that is being operated under adverse conditions.

Let us consider as the first case in hand conditions illustrated in Fig. 1. The circuit A B C contains 15 telephones connected in series; the telephone B located in the town X serving as a means of communication to the outlying stations; the telephone E, which is also located in X, serves in a similar capacity for the telephones connecting to the D E F line.

Quite often and mainly on account of the difficulties improperly designed switching apparatus might introduce if placed at the junction point X, an oral repetition of messages is preferred; thus when a subscriber at some station on the line A desires to communicate with anyone on the line D, the operator at the junction point X is requested to repeat the message. In Fig. 2 a method is shown that may be employed with marked success. The diagram re-

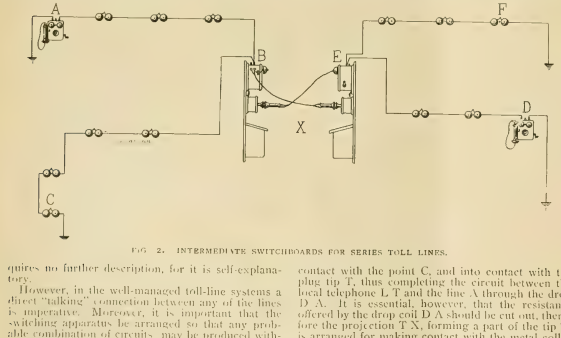


FIG. 2. INTERMEDIATE SWITCHBOARDS FOR SERIES TOLL LINES.

quires no further description, for it is self-explanatory.

However, in the well-managed toll-line systems a direct "talking" connection between any of the lines is imperative. Moreover, it is important that the switching apparatus be arranged so that any probable combination of circuits may be produced without creating any mutual interference. Another and equally important requirement is that the toll switchboard must be designed so that it is practically impossible to "hang up" any toll line circuit and produce at the switchboard a condition in the circuits which will prevent the recalling of a call originated at any of the outlying toll-stations. Fig. 4 represents the circuits of a toll switchboard designed for accommodating series-connected telephones employing the earth or a common wire as the return circuit. For the sake of clearness only two drops and jacks are shown. The line A connecting to D A and J A, and the line B to D B and J B.

Although we have shown the ordinary annunciator drop serving as the signal receiver, it is generally advisable to install instead a magneto bell, for, when a number of telephones are connected in one circuit, a system of code signaling becomes a necessity, and unless the operator at the switchboard is in constant attendance a code signal, though intended for someone on the same circuit, would be the cause of many useless trips, as the drop would indicate a call on the passage of the first impulse of current, thus calling for immediate attention, whereas the bell signal would only call the operator when sounding the local code. Regarding the difficulty experienced in locating the caller after the bell has ceased sounding, it can be met by arranging the magneto bells with indicating shutters such as are employed on the ordinary annunciator. However, with six or eight bells on one switchboard, an operator soon learns that each bell possesses, or may be made to possess a characteristic tone of its own; moreover, it is an easy matter to locate the caller, even if it is necessary to plug into several jacks until the proper one is found, for, in making a toll connection, the speed is not so large a factor as the certainty of its being properly executed.

Referring to Fig. 3, let us see what operations it is necessary to perform when telephone A desires to be put into communication with telephone B. Transmitting the call in a prearranged manner, it may be received at the switching station, either causing the falling of a shutter and closing a local bell circuit, or by sounding a prearranged code signal on a magneto bell. The switching station, it will be observed, is equipped with a regular telephone instrument. One of the line binding posts is connected to the earth wire and the remaining binding post is connected to a single conductor cord that has connected to its opposite end a single contact (common return) plug O P, which is so constructed that upon inserting it into the jack J A, the spring C C is forced out of contact with the point C, and into contact with the plug tip T, thus completing the circuit between the local telephone L T and the line A through the drop D A. It is essential, however, that the resistance offered by the drop coil D A should be cut out, therefore the projection T X, forming a part of the tip T, is arranged for making contact with the metal collar S, which when effected shunts the resistance out of circuit by reason of the collar S being connected to the line side of the drop coil. Therefore when either calling or talking over any circuit the operator has a direct connection to the line wire.

The operator, on being requested to produce a conversational connection between the A and B lines, inserts the operating plug O P into the line jack J B, and on finding the B line clear, at once proceeds to transmit the proper code signal for the desired station; on receiving a response, the C P connecting plug may be inserted into the jack J A, and after withdrawing the operator's plug from the jack J B the A P plug is inserted into the jack, thus establishing a through connection for the A and B lines. On closer examination it will be noticed that the C P plug is an exact duplicate of the operating plug, with the addition of a metal socket piece P S, which is in reality an extension of the tip T. The corresponding A P plug is also equipped with the tip T, and the socket piece P S, but the tip projection T X is not in an electrical contact with the plug tip T; in fact, the projection is merely an extension of the hard-rubber sleeve covering the larger body of the plug. As was described before, the metal projection T X serves as a means of shunting out the drop coil; therefore it is obvious that the drop coil must remain in the connecting circuit and operate as a clearing-out drop, whenever the A P plug is placed into a corresponding jack; whereas, the C P plug, wherever inserted, always shunts a coil out of circuit. Whenever the operator desires to listen to a conversation passing over the C P and A P plug circuit, it is only necessary to touch the socket piece F S with the tip of the operating plug O P. Listening buttons might be arranged and the listening-in would become more convenient, but considering the circumstances there is no valid reason for providing them, and therefore they should not be supplied.

The series connected toll-line system is liable to many interferences, but one of the most exasperating conditions is that which may be produced by the careless operator of some outlying toll station "hanging up" an entire circuit by allowing it to remain open at the switchboard. Referring to Fig. 3, it will be seen that the C P and A P plugs when in normal position allow the metal socket piece P S to rest in a seat provided in the plug supports C S and A S, thus completing the connection with the earth through a low-wound annunciation bell B B. Now, in case either the C P or A P plug is accidentally left in one of the line jacks, the conditions are not materially changed, for the magneto bell E B always presents an easy path to the earth for an incoming call, even if the drop coil D A has been shunted out of circuit as by the C P plug. If the plug O P belonging to the operator's telephone be left in one of the jacks, the telephone bell would naturally act as the receiver for that particular line.

As stated before, it is an easy matter to design a switchboard for interconnecting series toll lines, but when the designer is obliged to exercise an extreme degree of economy, and at the same time produce apparatus than can be understood by the most inexperienced manager, the problem assumes a more difficult aspect, for every additional connection, appliance or piece of apparatus tends to confuse the mind, and, though perhaps the arrangement produced may not be theoretically correct, it is the practical feature which is the most desirable.

Telephone Legislation.

Restrictions of telephone business are proposed by the anti-Bell forces in Maryland.

Two bills have been introduced in the Legislature regulating rates for service. One prohibits telephone companies from charging more than $5 per month for a telephone located within a radius of three miles from the central exchange, and $1 additional per month for every extra mile. When two or more telephones are rented on the same subscriber, not more than $4 shall be charged for each. The second bill repeals the act of 1894, which permitted a telephone company to make special contracts with subscribers. At present the Bell company evades the law which compels a like charge for a grounded circuit by using a metallic circuit and increasing the rates.

The act of 1892, under which the Bell company operated, provided that rentals for local service should be limited to $6.50 a month or $78 a year, and in 1894 the Chesapeake and Potomac Telephone company secured from the Legislature permission to make special contracts with customers for their benefit. Thereupon the company construed the amendment to mean that for $78 a year only the grounded circuit should be given. For an ordinarily good telephone of the metallic circuit the company put the price at $125 a year, and everybody who wanted a satisfactory service had to take it. It is this condition that has made possible the present crusade against the Bell interests in Maryland. It is believed as a result of the agitation that the "special-contract" feature will be abolished and that reasonable rates for first-class service will be established by law.

COMMUNICATION.

Auxiliary Telephone Signals.

To the Editor of the Western Electrician:

In the article which was published in the Western Electrician, April 30th, on "Auxiliary Signals as Applied to the Telephone," Fig. 11 should be made to read Fig. 12, and vice versa, and the switch S in Fig. 5 should have been connected as the switch S shown in Fig. 6, thus conforming with the description "the switch S connected across the extension bell terminals."

H. P. CLAUSEN.

Chicago, May 11, 1898.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

J. T. Davis has sold his stock in the Perry Telephone company of Perry, Iowa, to H. L. Thomas, and Edmund Nichols has sold his to John R. Swearingen. The company has completed its new line to Guthrie Center.

The Greene and Western Telephone company has been incorporated at Greene, Iowa, with $2,000 capital stock.

The Central Telephone company claims to have secured 400 subscribers in Oskaloosa, Iowa, and is doing well in Pella, Iowa, and other towns along the line of the proposed toll line from Des Moines to Ottumwa.

The Southern Dakota Telephone company is working to establish its lines in Mitchell, S. D., Chamberlain and other points.

Frank Lashway, telephone manager at Chippewa Falls, Wis., for the Wisconsin Telephone company, was married at Appleton, Wis., to Miss Allie Waldo.

The Hastings Telephone company of Hastings, Minn., has received materials and instruments for completing its system and will soon be ready for business.

The Elgin Telephone company of Elgin, Minn., is extending a line to Corra and may go west of there.

The Blue Earth Valley Telephone company will put in a new 200-drop switchboard and move its exchange at Blue Earth City, Minn. The changes will cost about $1,500.

The council of Thorp, Wis., is considering a franchise for the Wisconsin Telephone company.

Byron F. Fahnestock, manager of the Northwestern Telephone Exchange company's St. Cloud, Minn., office, has been transferred to Minneapolis. He is succeeded by C. H. Edwards, formerly manager of the Minneapolis branch office.

The Dwelle Telephone company of Lake City, Minn., expects to put in a metallic circuit from Lake City to Wabasha, Minn., as soon as possible.

The Minnesota Central Telephone company has arranged to extend its wires to Browns Valley, Minn.

The Northwestern Telephone Exchange company attempted to set poles on Lake street in Minneapolis recently. The city engineer had granted a permit, which was revoked afterward on account of the protests of property owners. The company went ahead and there was an exciting though bloodless contest until a sufficient force of police arrived to stop the work. The foremen of the gangs were arrested. The company holds that the city engineer has no right to revoke the permit after expense has been incurred.

Australian Telephone Statistics.

T. Howard, honorary secretary of the Telegraph Electrical Society of Melbourne, thus rebukes the London Electrician for copying from Electrical Engineering of Chicago an incorrect statement of the number of telephones in service in Australia:

"The number of telephones in use in Australia is given as 2,000, and as New Zealand is not mentioned in the list it may be assumed that that colony is included in the Australian total. From official returns at the beginning of 1897, the following telephones were in use in the various colonies, viz.:

"Tasmania and South Australia: Subscribers to exchanges 685 and 1,099 respectively.

"Western Australia: Exchange subscribers 942, private lines and extension telephones 157.

"New South Wales: Subscribers to exchanges (city, suburban and country) 3,991, extension lines 678, private lines 4[illegible]6, extra instruments in use 354, total 5,459.

"Victoria (end of 1897): Subscribers to exchanges (city, suburban and country) 3,088, private lines 185 (tenants in large buildings where sub-exchanges exist are not counted as subscribers); total telephones in use 5,000.

"New Zealand: Number of subscribers or connections March 31, 1896, 5,143; March 31, 1897, 5,747.

"So that the grand total of the whole of the Australasian colonies is 19,089.

"It must be remembered that this does not represent the telephones in use up to date. During the last year, owing to reductions in charges, there was an increase of over 2,000 subscribers in New South Wales alone, the number of telephones in use there in February, 1898, being 7,800. Allowing a proportionate increase on previous figures for the other colonies, it can fairly be stated that the total number of telephones in use in Australasia at present will be nearly 25,000, and not 2,000, as mentioned in the statistics of your contemporary."

Telephony in England.

In striking contrast to the complaints that have recently been published against the National Telephone company of England is the statement of the general manager of the corporation, William E. L. Gaine, at the annual dinner of the staff which was held in London last month. In the course of his address, he said:

"We have opened no less than 90 new exchanges; we have increased our clientele by upwards of 12,000 subscribers, after allowing, for those who from one cause or another cease to be subscribers, and we have now in this country nearly 800 exchanges in working order. Happily the great municipalities have recognized the enormous commercial advantages of the telephone as a means of communication, and have recognized that it is advisable in the public interest to make arrangements with the company which is charged, as the agent of the state, with the provision at the present time of this service, and the consequence has been that during the last year we have been able to make great strides in all the great English towns towards placing our wires underground and in bringing our plant—or doing something towards bringing it—into the most efficient condition for giving a service such as we know we can give, and such as the public has a right to demand. Now, with these facts before us, and knowing, as we know, the difficulties which have to be overcome, it is somewhat hard to find that the charge meets with acceptance, more or less, that the service rendered by this company is not an efficient service. I deny that entirely. I say that where facilities have been afforded, where we have had the opportunity of showing what we can do, the service of the National Telephone company will bear comparison with any telephone service in the world. It is said that figures cannot err, but they often lead people who use them to err very materially. Now an inefficient service which has conveyed about 430,000,000 effective messages surely cannot be truly said to be bad, particularly when this figure is compared with the number of messages in a corresponding service—that which is rendered by her majesty's government in the matter of telegraphs—73,000,000. I do not know that the telegraph service is inefficient, but there are the figures 73,000,000 telegrams by the State Department, whereas the National Telephone company is sending 430,000,000 telephone messages per annum.

"I took the trouble a little while ago to make inquiries about the telephone business of some other countries, because we hear a good deal about other countries in this connection. Germany strikes me as being not an unimportant quarter of the globe, and what are the facts there? Germany has a population of about 52,000,000, and is, we are told, well telephoned—cheaply and well telephoned. In Germany, with 52,000,000 of population, there are 107,000 subscribers' lines. In England, which is inefficiently and, I think they say, inadequately telephoned, with a population of 38,000,000 to 39,000,000, we have 106,000 subscribers' lines—not such a bad comparison. So that for every 300 of the population in Great Britain you have a telephone subscriber, and in Germany one for every 400. France considers itself one of the great powers; and in France, with a population which is, for comparative purposes, simlar to our own (39,000,000), there are not more than 30,000 subscribers; that is to say, one for every 300 of the population here, one for every 1,200 in France. Austria is a great country, but there you have only one subscriber to every 1,500 of the population. In Belgium there is one subscriber to every 680 of the population, and in Holland one to every 1,000. In view of these figures, and knowing what we are doing, what the enormous vitality of this business is, and its constant increase, and then to say that this country is inefficiently telephoned is nonsense, and we know it to be nonsense."

Another speaker, Lord Harris, complained of the number and nature of the "official inquiries" that had been held recently and of the attitude of those conducting them toward the corporation. He believed that many of the complaints against the service were unjust and without good cause. A case in point is cited as follows: "If any one of us sees a friend on the other side of the street talking with somebody else, and we want to speak to him, we have to wait until he has finished his conversation with the person with whom he is speaking, and yet the public—the uninstructed public—expect to get immediate connection with the person they want to talk to through the telephone, and complain if they get the response 'engaged' from the operator. Is that, after all, very remarkable? We know, as a matter of every-day experience, that we cannot get face-to-face conversations with our friends exactly when we wish. Is it, then, strange that it frequently happens when we want to talk over the wires, that they are engaged?"

Other speakers followed in similar strain, some as representatives of the company and others as subscribers, and all agreed that the service was highly efficient and satisfactory.

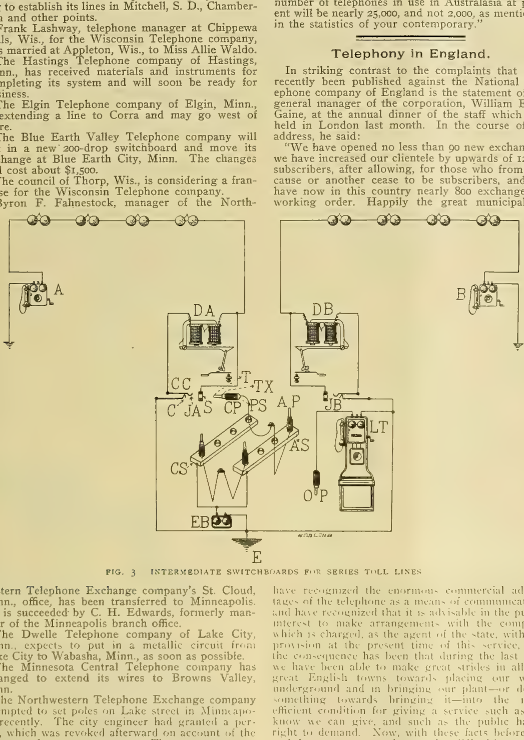


FIG. 3 INTERMEDIATE SWITCHBOARDS FOR SERIES TOLL LINES

Extensions and Improvements.

Buffalo aldermen have declined to grant franchises to two applicants for telephone rights.

The Pacific Telephone and Telegraph company of San Francisco is removing its overhead wires and poles. A subway system is being installed.

Chattanooga, Tenn., is considering the question of granting a franchise to a new telephone company, as the high rates of the East Tennessee company cause much complaint.

A telephone exchange will be established at Durand, Mich., a franchise having been granted by the council. The exchange will be in operation by August 1st, and the rates will be $20 for business houses and $15 for residences.

Clergymen enjoy telephone service free in Monroe, La., where the Cumberland Telephone and Telegraph company is engaged in a rate war with the new Monroe Telephone company, resulting in a reduction in cost to 50 cents a month.

The Missouri and Kansas Telephone company has decided to construct a line from Pittsburg to Chanute. The company will also build a line from Joplin to Springfield, Mo. It is intended to construct a network of telephone lines in Kansas and Missouri.

The Delaware County Telephone company of Chester, Pa., has decided to extend its lines to all important points in the county during the present year. The company will probably increase its capital stock from $25,000 to $75,000.

At the annual meeting of the Oriental Telephone and Electric Light company, which was held in London recently, the chairman called attention to the fact that the net profits exceeded those of the previous year by £1,000. The expenditure had been increased by the removal of the exchange to a more central position and providing a new switchboard. The rate of exchange had been more favorable than it had been for the last seven years. Business all round had been making steady progress and the outlook was exceedingly promising, he said.

George W. Schening of Memphis, Tenn., has sold his telephone exchange at Corinth, Miss., to the Cumberland Telegraph and Telephone company. This system consisted of 100 telephones and a 150 number switchboard. The Cumberland company has also purchased the telephone exchange at Winona, Miss., which has been operated for about two years. Mr. Harvey had 50 instruments connected to a 60 number switchboard. Since the Cumberland Telegraph and Telephone company purchased the Southern Bell telephone interests, it has been making great improvements, and is now rapidly extending the long-distance service south, east and west from Memphis. At present the lines extend about 100 miles south, where they branch off, going under the Mississippi River at Helena, Ark., and west along the Iron Mountain branch of the Southern Pacific railway. The company will soon open offices at Pine Bluff and Little Rock, Ark. The new manager of the Cumberland company, Leland Hume, is introducing many improvements in the service.

WAR NEWS.

[*Continued from page 283.*]

front of the armory on Main street, on the afternoon of Sunday, May 1st, the company having boarded the two cars seen in the distance, while those in front of the armory and in waiting are being filled by veterans of the late war and veterans of the company. The parade at the Falls was very notable from the fact that two companies of firemen from Niagara Falls, Ont., crossed the steel arch bridge and, headed by the Union Jack and a Canadian band, took part in the demonstrations of the day. The appearance of the British flag in the line created intense enthusiasm. It is probable that such an exhibition of friendship was never before shown as that of the flag of a neutral country floating in line with troops of another country who were departing for the scene of battle. The feeling of the Canadians was increased by the fact that Fred C. Newman, one of the marines lost on the ill-fated Maine, was a member of one of the Canadian fire companies, and his brother carried the British flag in the parade. The charge of the Canadians to the departing troops was, "Remember the Maine, and we'll remember you." The incident will attest the friendship that exists between the two peoples of the Niagara border, and has still closer cemented the ties."

The Manila-Hongkong Cable.—It appears that the cutting of the cable which connects Manila with Hongkong and the rest of the world was done by Admiral Dewey. The American commander regarded this action as necessary because the Spaniards had control of the land end of the cable and could avail themselves of this means of communicating with Madrid pending the surrender of Manila. As the admiral had not a sufficient landing force to capture the cable office, he decided to cut the cable, so that the enemy might have no advantage over him in telegraphic communication. It is reported that he sent word to the governor by the British consul that if he was permitted to send his dispatches to the United States government the cable would not be cut. The governor refused to promise, and Admiral Dewey decided to stop all communication between Manila and Madrid. The cable was cut on Monday, May 2d, the day after the battle.

In relation to the break in the service the manager of the Western Union office at New York gave an interesting interview to a reporter of the New York Sun: "We received no notice," he said, "of the nature of the interruption, of its cause, or of its probable duration. All notices of breaks in cable service come to us from Berne, Switzerland. At Berne is the Bureau International des Administrations Télégraphiques. This bureau is the center of all the government telegraph systems all over the world. There they meet in conference. There are between 40 and 50 governments which control their telegraphs as the United States does its mails. These form the 'signatory powers,' as they are called. The various privately controlled systems, perhaps between 15 and 20 in all, are admitted by courtesy to the conference held at Berne. So all notify Berne of any interruption in the service of their systems. Berne sends notices to every system, which in turn notifies its own offices. Yesterday the Eastern Extension system, which is under the same control as the Eastern company, notified Berne of the interruption between Hongkong and the Philippines. As to repairing such a break, if the weather is favorable and the repair ship is on the spot, connections can be made in an hour. But I do not know where that system has its ships at present, and it may take two weeks to get them to Manila. Hongkong is the nearest point to Manila that we can reach, and Labuan in Borneo the next nearest. We have had no interruptions in cable connections with Cuba or Porto Rico except in the way of censorship."

Some discussion has arisen as to the legal aspects of Admiral Dewey's act. It is generally held that all nations reserve to themselves the right to cut submarine cables in wartime as a military necessity or belligerent right, but it is possible that a civil claim for damages to the service may be admitted.

Foreign Telegraphers Dismissed.—At the request of Lieutenant Maxfield, U. S. A., the government censor, all the foreign employes in the offices of the United States and Hayti Cable company in New York have been "laid off" from the company's service, their places being filled by native-born American citizens. This action is only precautionary, as no suspicion of bad faith or irregularity attached to any of the persons who have been discharged. It is also said that secret service men have been detailed to duty in the cable company's office to watch all persons who may offer for transmission dispatches suspiciously worded or written in cipher.

Value of Searchlights.—If the Spanish fortifications at the entrance to Manila Bay had been provided with electric searchlights the American fleet would not have passed them as easily as it did at night, securing an advantageous position to attack the Spanish fleet at dawn. John McCutcheon tells the story in his graphic account of the battle cabled to the Chicago Record from Hongkong: "Only the signal lights absolutely necessary were shown after leaving Subig Bay, and before the attempt was made to run past the forts of Corregidor all lights were ordered extinguished. As the ships approached the south channel entrance to the harbor they slowed up. Each ship carried a single stern light that would not have been visible from the shore under any circumstances. The McCulloch being at the rear of the line, we who stood on her deck could mark the formation of the fleet by the dim waver of small lights moving ahead of us. We could see no lights ashore and were relieved to find that the enemy had no searchlights. It was a good night for running past the forts. There was a moon, but the sky was full of shifting clouds which covered it at times. It is probable that the darkened vessels could not have been seen by anyone watching from either shore. The south channel is five miles wide, and it is said to be at least 200 feet deep."

This instance shows the real value of searchlights in night attacks on harbor defenses. The lesson should be taken to heart at home as well as abroad, if there are places open to attack still unprovided. It is to be noted that the government has completed arrangements for borrowing the electric searchlight at Mount Lowe, in California. It will be used at night to sweep San Francisco Bay and the Golden Gate. This searchlight was at the time of its construction one of the largest in the world. It was used at the World's Fair at Chicago.

The Signal Service.—Probably the largest and best-equipped body of signal men ever gathered together by the United States will accompany the troops to Cuba. This corps of wig-waggers will have everything which the science of military communication has invented and brought into use. Reels of telegraph wire, containing enough to run a line from Matanzas to Havana, and insulated so that it can lie on the ground if lack of poles, trees or fences prevent stringing the wire overhead, will be taken with the troops, the constructing party going with the invading forces stringing the line as the troops move forward.

On a flat car at Tampa is a military balloon large enough to carry two men. This balloon, says Malcolm McDowell in the Chicago Record, has its wagon train, steel flasks in which 200 cubic feet of hydrogen gas is compressed into one cubic foot, and a drum and reel for the rope which holds the balloon captive while the signal men are transmitting messages by flags or electric searchlights, or are making observations and drawing a map for the commanding officer. Lieut. Maxfield of the signal corps will have charge of the balloon, which will be about 30,000 cubic feet in size. The hydrogen gas is compressed into seamless steel flasks, the dimensions of each flask being one cubic foot. Into a flask 200 cubic feet of hydrogen gas is forced by powerful compresses stationed at the base of operations. The wagons of the balloon train will carry a number of these charged flasks. When it is intended to use the balloon 150 of the flasks will be used in inflating the balloon.

Capt. Robert E. Thompson, the first censor which the government placed over newspaper men in the Key West cable office, is the inventor of a unique bicycle to be used in laying a temporary telephone line. A reel on the bicycle contains several miles of two insulated copper wires. A commanding officer desiring to talk with another officer on the field sends the signal man on his bicycle. As the bicycle moves over the ground the wire is reeled off. At the end of the run the signal man dismounts, salutes and presents a telephone to the officer. He "rings up" the commanding officer, talks with him, hands the telephone back to the signal man, who at once retraces his track, the reel automatically picking up the wire.

Capt. Theodore Kane, U. S. N., in charge of the coast signal service of the Atlantic division, has established his headquarters on board the naval reserve ship New Hampshire. His assistant is Lieut. Duane, formerly of the naval reserve, but now of the regular navy. Four signal stations are now manned by the men of the First Battalion, namely, at Montauk Point, Quogue, Fire Island and Cape Henlopen. At each station are detailed a quartermaster and four men. Eight telegraphers of the newly enlisted First Separate Division have been detailed for work at these stations and at Washington. In addition, there are 12 operators of the new division under Capt. Kane on the New Hampshire.

Adjt. Gen. Barrett has sent from San Francisco to Gen. Greely, chief of the Signal Corps at Washington, information that 100 men of California's signal corps stand fully equipped and well qualified to go to the front immediately. The naval militia is urging the representatives of the state in Washington to help them get into action. They are extremely anxious to be assigned to duty.

Gen. Greely says that the telegraphic signal system is now complete for the entire Atlantic coast north of Fort Caswell, North Carolina, and the important defenses—particularly those at Boston, New York, Delaware and Chesapeake bays—are in close communication with each other and with Washington.

The Senate has passed the bill authorizing the enlistment of a volunteer signal corps. The corps shall consist of one colonel, one lieutenant-colonel, one major as disbursing officer, and such other officers and men as may be required, not exceeding one major for each army corps and two captains, two first lieutenants, two second lieutenants, five first sergeants, 10 sergeants, 10 corporals and 30 privates to each organized division of troops. Two-thirds of all officers below the rank of major and a like proportion of the enlisted men shall be skilled electricians or telegraph operators.

Captain William J. Lloyd, assistant district superintendent of the Western Union Telegraph company at Chicago, has resigned from the Signal Corps of the Illinois National Guard. John W. McConnell has been detailed to act as captain and will receive his commission, it is said, in a few days from Governor Tanner. Capt. Lloyd has taken great interest in the Signal Corps, and his skill and popularity have been of much value to the service.

Miscellaneous Notes.—A Cleveland dispatch states that Norman Harrington, the American engineer who faced the Spanish mob in Barcelona with the American consul, is a graduate of the Cleveland public schools and Case School of Applied Science in that city. He has many relatives and friends there, but his wife and children live in Chicago.

The Commercial Cable company sends out notice that the cable between Montevideo and Rio Grande do Sul is interrupted. This cuts off telegraphic communication with Montevideo and places south, including Buenos Ayres. The same company announces that it is advised that telegrams for Spain written in code or cipher will be accepted only at sender's risk.

The Tompkinsville lighthouse station on the Atlantic coast is now connected by telephone with the stations at Navesink, Montauk Point and Block Island. Connections will also be made with Fire Island. Orders have been issued to make telephone connections between all important lighthouse stations.

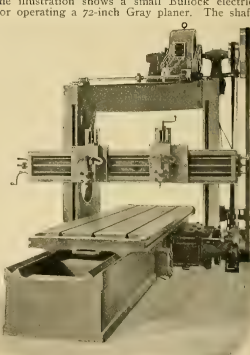
WAR OPINIONS.

[*Continued from page 283.*]

J. E. Keelyn, Western Telephone Construction company, Chicago: My belief is that the war will be of short duration. The large expenditures necessary will have a stimulating effect upon trade which will be more felt later on. The depressing effect upon stocks and financial institutions will not suffice to interfere very greatly, although concerns doing business upon borrowed capital will be in a weakened position. The electrical trade has passed through a period of depression and injudicious competition, resulting in an experience that warrants reasonable hope of a gradual improvement, even under war conditions, and a tremendous development under favorable conditions without war. The Western Telephone Construction company is increasing its capacity 50 per cent., and, therefore, is proceeding upon the indications of enlarged business prospects.

Motor-driven Planer.

The illustration shows a small Bullock electric motor operating a 72-inch Gray planer. The shaft



MOTOR-DRIVEN PLANER.

of the motor is coupled direct to the main driving shaft of the planer. The motor is placed on top of the tool allowing a traveling crane to pass over it. It is shunt wound to give constant speed under varying loads and has a capacity of 12 horse power. The Bullock Electric Manufacturing company devotes especial attention to the electrical driving of machine tools.

Electrical Incorporations.

Electric Street Railway company, Bloomington, Ill., to build a street railway; capital stock, $20,000; incorporators, W. H. Beaver, J. W. Gray and J. Y. Chisholm.

Desplaines Valley Electric Railway company, to construct a railroad from some point in the township of Lyons to some point in Chicago; capital stock, $100,000; incorporators and first board of directors, Nelson F. Merrill, Hiram A. Johnson and H. Wallace Percell of Chicago, Henry B. Fargo of Geneva and Samuel S. Garman, Jr., of Oak Park.

Regulation of Compound-wound Dynamos.

[*Continued from page 281.*]

The claims of the Brush patent are as follows:

1. In a dynamo-electric machine, the wire or helix E, having a comparatively high resistance and kept constantly in closed circuit while the machine is running, in combination with the magnet wire or helix F, as commonly employed.

2. In a dynamo-electric machine in which the coils around the field-of-force electro-magnets are included in the main or operative circuits, the combination of such main circuit with a constantly closed differential circuit of prescribed resistance, for the purpose of maintaining the flow of the current through the coils surrounding the electro-magnets in the machine when the main or operative (external) circuit is broken, substantially as shewn.

The Brush dynamo was intended for use in electroplating devices. A number of machines were built under the Brush patent and were successfully operated long prior to the date of the Edison application. Some of these are operative machines at the present time. Two of them are in evidence.

The defenses are lack of novelty and invention, and non-infringement. The principal defense is lack of novelty, and it is based upon the Brush patent just quoted.

The action was commenced December 23, 1893. It was argued February 8, 1898, and was finally submitted March 9, 1898. The record contains 2,454 printed pages and the briefs 800 printed pages.

Edmund Wetmore and Richard N. Dyer for complainant.

Henry A. Seymour, Robert S. Taylor, Charles A. Brown and Seward Davis for defendants.

Coxe, J.

Although this record has been expanded beyond reason and precedent, it will be noted that the real issue is one of the simplest that can arise in a patent cause, viz., whether the patent is invalidated by a single prior patent?

The best evidence of what the patent covers is the patent itself. It states that it is for "a new and useful improvement in regulating the generative capacity of dynamo-electric machines." The claims are for the dynamo in combination with translating devices in multiple arc; but as this arrangement of translators has been well known since 1875, invention cannot be predicated of this element of the combination; indeed there is no pretense that it can be. If invention can be found at all it must, therefore, be in the dynamo.

The object of the patentee was to produce means, assuming the translators to be lamps, by which the turning on and off of the lamps shall cause immediately a proper regulation of the current energizing the field magnet of the dynamo without the help of any other mechanism. In short, the dynamo was expected automatically to adjust its generative capacity. The translating devices shown in the drawings are lamps, but the claims are not limited to lamps and there is no canon of interpretation familiar to the court which will justify a construction so narrow. The claims do not speak of lamps. The words are "translating devices," and there can be no doubt that any translating devices arranged in multiple arc are within the claims, which unquestionably cover motors, plating baths, heaters and other similar devices.

The drawing shows a rudimentary dynamo of the conventional Edison type. It is the same dynamo which appears, mutatis mutandis, in a large number of patents which emanated about the same time from the Patent Office.

The dynamo of the drawing has compound windings, a vertical field magnet with pole pieces at the bottom and a field wound with two coils -a shunt coil of high resistance and a low-resistance coil in series with a lamp circuit. The shunt circuit may, if desired, be supplied from an external source. The main conductor is brought up on one side and wound around the magnet, afterward extending out parallel with the outer conductor of the exterior circuit.

The specification states that when translating devices are first put in circuit the magnet is sufficiently energized by the interior circuit, but as the number of translators is increased the resistance of the exerior circuit is lowered, and as they are thrown out of resistance of the main circuit increases and the energy of the magnet is lessened by the decrease of current in the main conductor. This is practically all there is of the specification. Considering the far-reaching, all absorbing claim which is now asserted for this patent, it must be admitted that the specification is most meager and unsatisfactory. It is almost a skeleton. If it were expressed in the full, clear and concise terms required by law, it is fair to presume that the expert witnesses, at least those on the same side of the controversy, would agree as to its scope and meaning. It will be observed that it says nothing about "constant potential," or, except inferentially, the means of securing constant potential. All details as to size of the field magnets, the relative size of the coarse and fine wire and the length and number of coils of fine wire are omitted, and yet it is maintained that sufficient information is conveyed to enable an electrician to construct the highly organized and efficient machines of the present.

The combination of the first claim contains the following elements:

1. A dynamo. 2. Translating devices arranged in multiple arc. 3. Field circuit of constant resistance for primarily energizing the field magnet. 4. Another field circuit whose resistance is varied by the addition and removal of translating devices.

The elements of the other claims are substantially similar, and in view of the conclusion reached it is unnecessary to consider them in detail. Claim 3 differs from the other two, in that the shunt circuit must be supplied from the main conductors.

It will be seen that the first claim is not for a dynamo of the Edison type or for the system of electric lighting adopted by him, but, on the contrary, that it is broad enough to cover, and does cover, any dynamo having the described characteristics in combination with any translators in multiple arc.

The Brush patent relied upon by the defendants was applied for 17 months before, and was granted one month before, the earliest date fixed for the alleged Edison invention.

The Brush patent is for an improvement in dynamo-electric machines and has for its object the maintenance in such machines of a magnetic field while the machine is running, whether the external circuit is closed or open.

Without analyzing the patent in detail, suffice it to say that the description is specific, carefully drawn and clearly illustrated by diagrams. The dynamo of the patent is a compound-wound dynamo having a shunt and series coil, the former of high resistance and the latter of low resistance. In some of the figures the series coil is wound over the shunt coil; in others the shunt is wound over the series, and in another figure the two coils are wound on opposite ends of the same core. The dynamo is designed to generate and maintain a sufficiently constant electromotive force and produce an amount of current always corresponding to the amount needed by the devices in the working circuit. Mr. Brush shows his machine in combination with electroplating in multiple arc, and Mr. Edison shows his in combination with electric lighting in multiple arc. This is the principal distinction between the two. If the one multiple-arc circuit be the equivalent of the other, then it cannot be denied that every element of the patent in suit is found singly and in analogous congeries in the Brush patent and that they are described there so as to be more readily understood, at least to the uneducated lay mind, than in the Edison patent.

Not only is this clear from the Brush patent, but the proof shows that a number of machines were built pursuant to its directions and were commercially used more than two years prior to the date of the application for the Edison patent. These machines exist at the present day, and what is quite remarkable and almost unique in patent litigation is the fact that, in an art which has progressed with giant strides, machines made nearly 20 years ago are not only operative, but practically as successful as when first built. Two of these working dynamos have been introduced in evidence, one by the complainant and one by the defendants. Each is capable of doing the same work now as in 1880. All of the Brush dynamos were originally used in electroplating devices. That a plating bath is a translating device, that the articles placed therein to be plated are connected in multiple arc and that such an arrangement is the equivalent of a multiple-arc lamp circuit, seems to be established by an overwhelming preponderance of evidence. Not only do the expert witnesses called for defendants testify to this, but so also does the principal expert witness for the complainant, whose vast fund of information regarding matters electrical is well known to this court. Not only so, but the proposition has received judicial sanction in the "Feeder case," where the Court of Appeals for the Third Circuit say:

> In the art of electroplating, as practiced long before 1880, we find an arrangement of circuits substantially the same as that of the patent in suit. Here a large number of articles to be plated simultaneously are suspended in the bath by separate wires attached to a metallic rod placed across the top of the tank, that is to say, the articles are arranged in multiple arc with respect to the electric current. Westinghouse v. Edison Co., 63 Fed. Rep., 588, 594.)

It must be conceded, therefore, that if the claims of the patent in hand are to be construed according to the plain letter of their meaning, without importing therein limitations and refinements not found in the patent, but suggested by subsequent and more accurate knowledge, the patent is invalidated by the patent to Brush and the machines made in accordance therewith.

But it is argued that the patent is for a peculiarly regulated compound-wound dynamo which secures constant, or nearly constant, potential in combination with incandescent lights arranged in multiple arc or other analogous devices requiring the same constant potential. In brief, that it is for the Edison dynamo in combination with the Edison system of electric distribution. It is maintained that the Edison patent discloses all this and the Brush patent does not disclose it.

Even though this position could be maintained, it is still a question whether it involved invention to secure more accurate regulation after the Brush patent had told the electrician how to secure regulation sufficiently perfect to be successful in the electroplating art. It would then seem to be a mere matter of winding within the knowledge of the skilled electrical engineer.

But a sufficient answer is that the courts are not permitted to construe a patent by reconstructing it to conform to what the court may think was in the mind of the patentee at the time.

Assuming that the dynamo shown in the Edison patent could be used for electroplating and was so used in place of the Brush dynamo, it would not have conveyed to the art any information for producing constant potential which was not conveyed by the Brush dynamo. Translating devices which require constant potential should be harnessed to a dynamo which produces constant potential, but it does not follow that because they are shown thus diagrammatically connected that the dynamo so described will secure constant potential or tell others how to secure it.

The Edison patent, as before stated, says nothing regarding constant potential and gives no information as to the means of securing it which is not found equally well stated in the prior patent. The claims are perfectly clear and intelligible, and there is no precedent for reading into them limitations not found in the patent. White v. Dunbar, 199 U. S., 47; McClaim v. Ortmayer, 141 U. S., 419; Home Co. v. Singer Co., 68 Fed. Rep., 224.

It is doubtful if Mr. Edison had in mind at the time he applied for the patent all of the improvements, perfections and refinements which are now asserted.

In 1879 the art of electric lighting was in its infancy. With the modesty which is usually found in men of genius, Mr. Edison frankly admits his lack of knowledge upon the subject now under discussion. He says: "As I knew nothing about dynamo machines, I tried to get information from electricians and books." His memory is also vague as to the success of the compound-wound dynamo. He recollects that there was a great deal of trouble with the machines; none of them worked; but he attributes their failure to variations in the speed of the engine that operated them.

Mr. Brush, on the other hand, thoroughly understood compound winding in connection with other devices in the art of electric lighting and had proceeded far in the successful construction of dynamos.

Were it important to inquire which of these two men would be most likely to produce a working machine having the necessary characteristics, there can be little doubt that Mr. Brush would be chosen. But such an inquiry seems irrelevant. The patent law cannot be administered along such lines as these. Patents are formal grants controlled by carefully drawn statutes and strict rules, and must be construed as other similar documents are construed. The court is not permitted to inquire what the patentee might have done or was capable of doing. The question is: What did he do? Conjecture and speculation are out of place in interpreting the claims of a patent. But even if the claims be limited to incandescent lamps in multiple arc circuit, it would seem that they are met by Brush dynamos. Several tests of these dynamos in connection with lamps were made, one of them being made at the argument.

The court makes no pretension to anything but a most superfical knowledge of this complex subject, which can hardly be mastered after the engrossing study of years, but it seemed to the court that the test demonstrated what the defendants sought to prove. The machine regulated automatically and maintained a constant electromotive force within permissible limits of variation. There was no noticeable variation in the lamps from no load to full load.

The other experiments described in the record appear to have been similar in character and to have had similar results. The court cannot resist the conclusion that the claims, construed as they must be construed, are invalidated by the Brush patent and the dynamos built thereunder. A Brush plating machine, if made now for the first time, would infringe these claims; being, in fact, made before, it anticipates them. But the learned counsel for the complainant insist:

> That even assuming the Brush plating dynamo to be a compound-wound dynamo within the scope of the Edison patent, there was, under all the circumstances shown by the record in this case, invention involved in the employment of such a dynamo in combination with a multiple-arc system of electrical distribution, on account of the discovery that such a dynamo, when the shunt and series coils were properly proportioned, would secure automatically the peculiar regulation to compensate for variations in the load which is required by such a system.

The doctrine of Potts and Creager, 155 U. S., 597, is invoked in aid of this contention.

As has frequently been pointed out, this case has created no new rule upon the question of double use. The case was peculiar upon the facts, which presented an entirely different condition of affairs from that developed in the case in hand. It has always been the law that invention must be denied to one who merely takes a device which has been used in the same or in an analogous art and uses it in new environments to accomplish a similar result. Stearns & Co. v. Russell, 85 Fed. Rep., 218, and cases cited.

It requires only the skill of the mechanic in the particular art to make the transfer from one branch thereof to another branch. An engineer who has used his engine to operate a series of looms knows enough to connect his driving wheel with a series of knitting machines, and a competent electrician who has used a dynamo successfully with one series of translating devices should be able to use it in connection with another series of translating devices. In other words, the character of the translating devices does not change the character of the dynamo, and an electrician does not become an inventor because he attaches a series of lamps to a dynamo which had been used in connection with a series of heaters.

The complainant's proposition, if sustained, would lead to the conclusion that Mr. Brush, after having obtained his patent in which the dynamo is described

as suitable for an electroplating circuit, could have attached the same dynamo to a well-known lamp circuit and have obtained another patent for that, and so on, as often as he changed the character of the translators.

Even though this work required enlargement, adjustment and some change in the winding, it would still be a question of degree within the realm of the skilled mechanic. An electrician would know how to adjust the machine to do the required work and adapt it to the new environment. An illustration is found in the record. Mr. Edison says that the first dynamo made by him did not work because of variation in the speed of the engine occasioned by poor governing, "as a compound-wound machine should have a regular speed to utilize the invention; but after a while the demand for close regulation was met and engine builders were enabled to build engines that were very reliable, and then the conditions for the employment of compound machines were met."

It will hardly be pretended that the engine builder who produced better regulation as the demands of the market required it was entitled to a patent. It would seem also that a skilled electrician would know how to adjust the Brush compound-wound dynamo to the new conditions of an incandescent-lamp circuit the moment the two were brought together. It would be like operating a carriage with a motor which had previously propelled a boat, or using a bullet-mold for making pills.

To restrict the Brush patent to electroplating would be as unfair as to restrict Edison's to electric lighting. The one illustrates his dynamo in connection with the first-named translating devices, and the other with the second-named devices.

As before stated, the patent cannot be limited to any one multiple-arc system of electrical distribution, but if it could be, invention is not involved in changing one series of translating devices for another.

It seems probable that, if this controversy related to any other machine for generating and regulating power, contention would cease the moment a device was discovered in the prior art as near to the patented machine as Brush is to Edison. The mystery and uncertainty which surrounds everything relating to electricity and the feeling of admiration, almost akin to reverence, for those men who have subdued this unknown and dangerous force and made it do the world's work, makes the court diffident about applying those principles which are axiomatic in the patent law. There is always the apprehension that injustice may be done through failure to comprehend the abstruse and difficult problems presented. This fear has been augmented in the present instance and the difficulties of understanding the problem involved have been vastly increased by the record, into which has been dumped haphazard everything which either party believed had a bearing not only upon the point in issue, but upon the general subject of electrical distribution. But even were there more doubt as to the correctness of the conclusion reached, the court should still hestitate to enforce a patent in the sixteenth year of its age, and thus lay the entire art under tribute, when the public has had a right to assume that such a system as the defendants are using would not be molested. The bill is dismissed.

Patent Office Rules Amended.

The commissioner of patents has promulgated the following amendments to the rules of practice of the Patent Office with the sanction of the secretary of the interior:

Rule 135. Upon the filing of the appeal the same shall submitted to the primary examiner, who, if he finds it to be regular in form, shall within five days from the filing thereof furnish the examiners-in-chief with a written statement of the grounds of his decision on all the points involved in the appeal, with copies of the rejected claims and the references applicable hereto. The examiner shall at the time of making such statement furnish a copy of the same to the appellant. If the primary examiner shall decide that the appeal is not regular in form, a petition from such decision may be taken directly to the commissioner as provided in rule 145

Rule 145. Upon receiving a petition stating concisely and clearly any proper question which has been twice acted upon by the examiner, and which does not involve the merits of the invention claimed or the rejection of a claim, and also stating the facts involved and the point or points to be reviewed, an order will be made fixing a time for hearing such petition by the commissioner and directing the examiner to furnish a written statement of the grounds of his decision upon the matter averred in such petition within five days after being notified of the order fixing the day of hearing. The examiner shall at the time of making such statement furnish a copy thereof to the petitioner. No fee is required for such a petition.

National Electric Light Association.

President Insull announces that all the arrangements for the meetings of the National Electric Light association have been completed, and that with one exception the assignments for papers have been accepted. It is proposed to have six set papers, and, in addition, a number of topical discussions. Thus far five papers have been arranged for, but President Insull has not yet received formal notice of acceptance of the invitation extended to prepare the sixth paper.

The programme thus far includes the following list of papers:

"Cost of Generation and Distribution of a Unit of Electricity." By Calvin W. Rice.

"General Distribution from Central Stations by Alternating Currents." By Herbert A. Wagner.

"General Distribution from Central Station by Direct Currents." By Louis A. Ferguson.

"Public Lighting with Relations to Public Ownership or Control." By Alex Dow.

"Transformer Economy." By Winder Elwell Goldsborough.

It is expected that the discussion of the question of direct and alternating systems will bring out the special advocates of each method, and this feature, therefore, is anticipated with keen interest by practical central-station men.

The Trunk Line association, Central Traffic association, New England Passenger association, Southern Passenger association and the Western Passenger association have granted a rate of a fare and one-third, on the certificate plan, from all points in their territory to Chicago and return, for delegates attending the twenty-first convention of the National Electric Light association, to be held June 7th, 8th and 9th. The convention hall and headquarters will be at the Auditorium Hotel. The rates are $3.50 to $5 per day on the American plan and $2 to $4 per day on the European plan, for each person.

National Electric Light Convention, Chicago, June 7th, 8th and 9th.

The most popular line from Cincinnati, Louisville and all points South to Chicago is the Big Four Route via Indianapolis; magnificent sleeping cars and unequaled dining-car service. For maps, rates, etc., address E. O. McCormick, passenger traffic manager, Big Four Route, Cincinnati, O.

CORRESPONDENCE.

New York Notes.

New York, May 9.—The great electrical exhibition is, of course, the main topic of interest among electrical men hereabouts just at this time. It is truly a large and interesting display of electrical devices, from which the technical man can receive instruction and the casual visitor entertainment. The projectors of the show deserve the success which they seem likely to achieve.

It is said that the specifications for fitting the Forty-second street, Tenth-avenue and Boulevard surface lines with the underground electric system have been completed and that bids for the work will be advertised for within the next two weeks. It is expected that the change in the motive power of these roads will be complete by the fall. Mr. Lauterbach, the counsel for the Third Avenue company, states that probably within a year all the horse and cable lines operated by the Third Avenue company will be turned into underground trolley roads. The main line in Third avenue will, however, be the last to be so equipped. The company owns between 70 and 80 miles of tracks, and the cost of changing the power and providing new rolling stock will be at least $5,000,000. Work on the power house, which it is proposed to build at Kingsbridge road and Two-hundred-and-sixteenth street will be begun next month.

The Scientific Alliance, composed of the New York Academy of Sciences, the Torrey Botanical Club, the New York Miscroscopical Society, the Linnaean Society of New York, the American Mathematical Society, the New York Mineralogical Club, the New York Section of the American Chemical Society and the New York Entomological Society, is endeavoring to raise money to erect a building. Charles F. Cox is president of the Alliance and Prof. N. L. Britton is the secretary. It is the ambition of the active men in the movement to found an institution which should combine the objects of Burlington House and the Royal Institution in London. Burlington House is the headquarters of the Royal Society, the most famous scientific organization of Great Britain, and contains interesting astronomical, antiquarian, chemical and geological exhibits. The Royal Institution includes chemical laboratories, provides other encouragement for original research in chemistry and physics and gives free lectures. It was here that Thomas Young, Humphrey Davy, Michael Faraday, John Tyndall, James Dewar and Lord Rayleigh conducted their historic investigations. Plans have been prepared for the building proposed, which is to be 100 feet square and is intended to stand on a corner and occupy four city lots. The first floor is to have two rentable offices or stores for purposes of revenue, which is to be increased by letting lecture halls occasionally. Thus, it is hoped, all of the running expenses of the institution will be met. The main auditorium is designed to seat one thousand persons, and is reached through ample hallways from the street. On the second floor there are to be a large parlor or club-room for social purposes and an assembly room for large meetings. The remaining space on this floor and all of the third and fourth floors will be devoted to laboratories and small rooms for the societies. It is proposed to have four of the former and twelve of the latter. The fifth floor would be occupied by the library and reading-rooms, and would easily accommodate 200,000 books. It is estimated that the land for this hall of science would cost not more than $200,000 and the edifice about $300,000.

George Gould, the president of the Manhattan Railway company, has written a long letter to the Board of Rapid Transit Commissioners taking vigorous exception to the franchises prepared for the proposed Manhattan extensions. Mr. Gould undertakes to show the benefit his elevated roads have conferred on the city, how heavily they h. e been taxed and how foolish and perverse the com .issioners are. The tenor of his complaint is shown by the following quotation from his letter: "The trouble with your board is, I fear, deep seated. Your mission, as you conceive it, is to furnish rapid transit, by underground railways, at the city's expense. You are wedded to that scheme. Municipal construction of tunnels in New York city is the ambition of your official existence. The constitutional debt limit of the city having been reached, your scheme becomes Utopian and impossible. Why should it longer stand in the way of grants which, were it not for your favored project, you would gladly make to this company?" Mr. Gould does not, in set terms, refuse the commissioners' franchises, but again offers to build the lines on the terms his company wishes for itself.

M. S.

Canadian Intelligence.

Ottawa, April 16.—The Montreal Street Railway company is building 20 motor cars for the Kingston, Jamaica, street railway.

The Halifax, Nova Scotia, Electric Street Tramway company will spend about $50,000 in improving its plant. It has just installed two large generators.

E. F. Hutchings and others of Winnipeg, Man., ask power from the provincial legislature to construct an electric or steam railway from Winnipeg along the east side of Red River to St. Andrews Rapids.

The Ottawa Electric Light company has been given the exclusive privilege of supplying light and power in the city of Ottawa, on the condition that the price of light be reduced 40 per cent. This is the result of an application made by the Deschenes Electric Light company to be allowed to supply light and power to the people.

In respect to the proposed motocycle service to be established between Toronto and Richmond Hill this summer, it is said the initial car will be fitted with electric lights and buttons for the use of conductors and passengers, by which a warning may be given to the motorman to turn to the right or left. It is claimed that this car will develop sufficient power to ascend heavy grades between Toronto and Richmond Hill at a speed varying from six to 12 miles per hour, carrying a full complement of passengers.

The Ingersoll Packing company has contracted with the Canada General Electric company for a complete installation of incandescent lamps, arc lamps, motors and generators for its factories at Ingersoll, Ont.

By an agreement entered into upon the commencement of the road, J. H. Beemer had a two-years' option for the purchase of the Quebec street railway. It is now said to be his intention to purchase the road and to consolidate it with the Quebec, Montmorency and Charlevoix railway. The motive power of the latter road will at once be converted from steam to electricity. Later on an extension of the road will be made to Murray Bay.

The finance committee of the council of the city of Hamilton, Ont., recently considered the application of the street-railway company for concessions. The committee decided to ask the railway company what was the value of the property, and if it was prepared to sell and on what terms. If the railway company decides that it will not sell, it is unlikely the aldermen will grant any concessions, and if the company is willing to dispose of the plant at a reasonable figure the city will purchase the road and own and run it.

A. V. W.

Northwestern Notations.

Minneapolis, April 25.—It is understood that the different street-railway companies of Seattle, Wash., will be consolidated under one management this year. They have hardly paid expenses, but it is believed that with the saving that would come from a central power house and reduced forces in offices a paying investment would result.

The street-railway company has begun setting trolley posts for changing its Selby avenue cable road in St. Paul into an electric line. The device to overcome the hill will be put in June 1st, and it is expected to have the line running by electricity on July 1st.

The Parkersburg Electric Light company has been incorporated at Parkersburg, Ia., with $10,000 capital stock, and has just been granted a franchise by vote of the people.

One of the engines in the power house of the electric-light plant at Decorah, Ia., blew up recently. It tore away the rear part of the engine and damaged the brick wall considerably. The engineer was in another room and escaped injury.

The street-railway company at Madison, Wis., has made a number of minor changes and improvements and has added some new rolling stock.

The National Electric company of Eau Claire, Wis., shipped a car of electric-light machinery to Yokohama, Japan, recently.

The city of Rochester, Minn., is taking bids for furnishing equipment and installing it for an enlargement to the city electric plant. The plant has been overloaded for some time and has been reported to be absolutely dangerous. The boilers are worn out, and there has been a possibility of their

exploding at any time. The estimated cost of the addition is $20,000.

J. K. Tillotson of Oshkosh, Wis., has issued a prospectus of the proposed Oshkosh-Neenah line, showing that it expects gross earnings of $64,928; expenses, including a six per cent. dividend on preferred stock, $6,000, leaving a net profit on common stock of $25,594. He will apply for a franchise at Neenah at once.

The Roller Mill company of Sheldon, N. D., will put in an electric-light plant if sufficient patronage is guaranteed.

The council is considering an application for an electric-light franchise for Elkhart Lake, Wis.

The Rapid Transit company is preparing to extend its city loops in Waterloo, Ia.

L. D. Lane, proprietor of the electric-light plant at Hampton, Ia., has reduced the price on lights for business houses and dwellings.

A company is proposed at Ashland, Wis., to utilize the water power of White River and transmit it by electricity to Ashland. There is enough fall in the river to develop 1,500 horse power. Guy Cole of Beloit, Wis., is forming the company.

An electric railway line is projected between Logan and Magnolia, Ia.

The Electric Light and Power company of Oconto, Wis., was sold under a lien to Eller Pemperin.

The Winona Railway and Light company of Winona, Minn., wants permission from the council to take up the tracks to the East End and discontinue that line. The company says that unless this permission is granted it will be necessary to stop running all cars, as that line is a dead loss and under the present arrangement the whole system fails to pay expenses.

The electric-light plant of Bedford, Ia., has been completed and put in operation.

The council of Henderson, Minn., has reduced the meter rate from 12 to 8 cents per kilowatt-hour.

The Fox River Valley Electric Railway company expects to have cars running between Appleton and Menasha, Wis., soon. It will lay tracks in Neenah, as the council will grant a franchise. C.

PERSONAL

Mr. C. M. Baker has been appointed general superintendent of construction of the western division of the Postal Telegraph-cable company, with headquarters at Chicago.

ELECTRIC LIGHTING.

Bids will be received by the West Chicago park commissioners until May 24th for 218 arc lamps and 164 cut-outs and insulators. The specifications are on file in the engineer's office in Union Park, Chicago.

Mayor Harrison and City Electrician Ellicott have completed the location of the 2,000 arc lights which are to be added to the municipal street-lighting system of Chicago this year, and within 90 days 600 of them will be in service. Inside of six months all will be in use. New lights are placed in the Third to Tenth wards, Twelfth to Sixteenth, Nineteenth to Twenty-second and Twenty-ninth to Thirty-first wards, inclusive.

On the forenoon of Saturday last the plant of the Cicero Light, Heat and Power company was totally destroyed by fire, entailing a loss of $15,000. The fire was caused by sparks from a passing Chicago and Great Western engine, which lit on the roof. The building burned rapidly, and but little was saved. The company furnished light for Austin, a suburb of Chicago, and divided the western territory with the Cicero Water, Gas and Electric Light company. In the afternoon the Cicero town board made arrangements with the Oak Park Electric Light company to furnish Austin with light until the Cicero plant could be rebuilt. The necessary connections were quickly made, and Austin was lighted that night as though nothing had happened.

ELECTRIC RAILWAYS.

The committee on the District of Columbia has reported back to the House the bill for the extension of the underground system on the Metropolitan railroad in Washington, and its passage is urged by the residents along the proposed route, and is recommended by the committee.

The Marion City, Ind., Railway company, which has an electric line running from Marion to Jonesboro, and the Union Traction company of Anderson have combined to build a connection between Alexandria and Jonesboro, giving an electric line from Marion to Anderson and from Alexander to Elwood.

The Chicago City Railway company has made a formal application for permission to extend its temporary trolley line on State street north of Van Buren street and around the loop. This request is supported by petitions of business men in that part of the city. The council, it is expected, will pass an ordinance, but as Mayor Harrison refused permission under the "track elevation ordinance," it is not considered probable that he will approve the ordinance.

With a capital of $1,000,000, the Syracuse, Skaneateles and Moravia Railroad company has been incorporated to construct an electric road 40 miles long in New York through the counties of Cayuga and Onondaga, with the village of Moravia, Cayuga county, as its southern terminus, and the city of Syracuse as the northern. The directors are Wing T. Parker, Thomas W. Downing, John Andrews and Joseph Parker of Moravia and Henry J. Hibbard of Skaneateles.

Gen. John McNulta, receiver of the Calumet Electric Street Railway company of Chicago, has filed a petition asking permission to expend $60,000 in the improvement of the plant and the purchase of property for a terminal loop and transfer station at Sixty-third street and Stony Island avenue. The petition was granted. Competition between the Calumet railway and the South Chicago City railway is great, and it is necessary to extend the tracks from Sixty-fourth to Sixty-third street. It is intended to purchase the building at the southwest corner of Stony Island avenue and Sixty-third street, which will be used for a terminal loop and transfer station to the Alley "L" road. Two elevators will be put in to carry passengers to and from the Alley "L" platform.

TELEPHONE.

The Galena, Kan., Telephone company is commencing work on a telephone exchange in Weir City, Kan., which it expects to have in operation in a month or six weeks. When this plant is completed it will be connected with Galena and intermediate towns by a toll line. In Galena this company will soon replace its old 200-number switchboard with a 300-number metallic circuit board to accommodate the rapidly increasing business.

TELEGRAPH.

The Rocky Mountain Telegraph company, which has now in operation about 300 miles of line in Montana and the Northwest Territory, has been sold to the Postal Telegraph company, and on May 1st the new owner took possession.

The Canadian Pacific company has now begun to put up a new telegraph line entirely of copper along its road from Montreal to Vancouver, 2,910 miles. As the wire used weighs about 300 pounds to the mile, this will require about 390 long tons of copper.

TECHNICAL SCHOOLS.

The summer school of Cornell University, Ithaca, N. Y., will be opened on July 5th and continued until August 13th. Among other studies courses will be provided in mechanical drawing, electricity and magnetism (laboratory work) and experimental engineering. No educational requirements are stipulated for admission to this school. G. B. Preston is instructor in experimental engineering, and he can give further information as to fees and registration.

The register of the Lehigh University of South Bethlehem, Pa., for 1897-98 has been published and may be had on application to the secretary of the university. This institution has courses in civil, mechanical, mining and electrical engineering. The last-named leads to the degree of E. E. Advanced instruction is also given to graduate students. The faculty includes H. Wilson Harding, emeritus professor of physics; Joseph F. Klein, professor of mechanical engineering; William S. Franklin, professor of physics and electrical engineering, and Dr. Alexander Macfarlane, lecturer on mathematical physics.

Entrance examinations for admission to the Massachusetts Institute of Technology of Boston will be held at the institution and in a number of other places on June 30th and July 1st. In the West examinations will be held in Belmont, Cal., Chicago (in charge of Dr. H. H. Belfield at the Chicago Manual Training School, Michigan avenue and Twelfth street), Cincinnati, Cleveland, Denver, Detroit, Louisville, St. Louis and St. Paul. A second series of examinations will be held at the Institute in Boston for those unable to be present at the first. Detailed information is sent on request by the secretary of the school, H. W. Tyler.

ELECTRICAL SECURITIES.

The gross receipts of the Chicago Edison company for April were 20 per cent. greater than for the corresponding month for last year.

The passenger earnings on the Brooklyn Heights railroad system for April were $470,780, an increase of $48,485 over the corresponding month last year. The earnings on the Nassau system for the same period were $166,796, an increase of $25,356 over the same period of last year.

The first quarterly report of the Metropolitan Street Railway company of New York shows a remarkable increase in the gross receipts, the figures for 1898 being $2,423,255, against $2,002,462 for the first three months of last year. After paying all expenses of operation and fixed charges, the company shows a net surplus of $423,960 on the quarter's business.

The New Orleans Traction company reports gross earnings for March of $112,807, a decrease of $5,530 as compared with the same month of last year, and net $47,759, an increase of $1,489. For the three months ended March 31st the gross earnings were $332,374, an increase of $14,688 as compared with the corresponding period of last year, and net $141,705, an increase of $30,339.

The North Shore Traction company of Boston reports gross earnings for March of $105,960, an increase of $6,915 as compared with the same month of last year, and net $42,846, an increase of $6,606. For the first three months of the year the gross earnings were $288,681, an increase of $9,186 as compared with the corresponding period of last year, and net $85,699, a decrease of $6,458.

The Bridgeport, Conn., Traction company reports gross earnings for April of $25,900, an increase of $1,471 as compared with the same month of last year, and net $10,411, an increase of $2,439. For the 10 months ended April 30th the gross earnings were $273,817, an increase of $11,221 as compared with the corresponding period of last year, and net $124,197, an increase of $21,984.

The Columbus, Ohio, Street Railroad company reports gross earnings for April of $51,422, an increase of $5,962 as compared with the same month of last year, and net $24,602, an increase of $1,227. For the four months ended April 30th the gross earnings were $204,540, an increase of $21,749 as compared with the corresponding period of last year, and net $104,773, an increase $10,572.

TRADE NEWS.

The Link-belt Machinery company, Chicago, has recently established a branch office at 521 Seventeenth street, Denver, Colo. Mr. A. E. Lindrooth, the engineer in charge, will look after the company's interests in Colorado and adjacent states and territories.

Mr. Charles Blizard of New York, manager of the Electric Storage Battery company, has been remembering his many friends in the trade by presenting to each a box of thumb pins, to be used upon drawing tables, for securing blotters to desks and the like.

Stone & Webster, the electrical experts and engineers of Boston, announce that they have recently made arrangements with Prof. S. Homer Woodbridge by which his business of heating, ventilating and sanitary engineering will hereafter be intimately associated with their own electrical engineering work.

The city of Union Springs, Ala., is about to install an electric-light plant. The engine is to be a Ball engine, built by the Ball Engine company, Erie, Pa. Mr. Charles Doughty, Randolph, Mass., has recently ordered for his electric-light plant at Randolph, Mass., a 200 horse power vertical cross-compound Ball engine direct-connected to a 120-kilowatt generator.

The Buckeye special coiled-filament lamp has lately been given thorough and scientific test for watt consumption, candle power maintenance, etc., at periods of 200, 400 and 600 hours, on the lines of a number of central stations and isolated plants. The results were very satisfactory. The Buckeye Electric company contends that it "pays to deliver what you sell." Catalogue and prices are sent on application to the Chicago office, 753 Monadnock building.

The Sprague Electric company "points with pride" to its Alley "L" railway equipment in Chicago, now partially in operation. It is claimed that the old service will be given with 15 per cent. less cars by reducing the time schedule, as can be done by the perfectly controlled electric cars. The Sprague company also announces the equipment with Lundell driving motors of the plant of "The Galvanoplastic" in Berlin, and states that motors have also been shipped in considerable numbers to India and Japan.

Geo. W. Patterson reports that the two companies he represents—the American Circular Loom company and the Gordon-Burnham Battery company—have removed their Chicago offices from 1114 to 1539 Marquette building, and invites all old friends and customers to come up and have a birdseye view of the city. The conduit business, Mr. Patterson says, was never so good before, and is increasing, while the merits and low prices of the Phenix batteries are beginning to be recognized in a flattering manner.

The Westinghouse Electric and Manufacturing company is building two three phase belt driven generators, each of 500 horse power, 3,000 alternations and 2,400 volts, for the Canadian Niagara Power company at Niagara Falls. The success of the 5,000 horse power machines built for the Cataract Construction company has encouraged others to enter the field for harnessing Niagara, but, like the pioneers, the new comers seem to go to the

Westinghouse company for the apparatus which makes these operations possible.

The Western Electric company has issued a 24-page pamphlet on tools which contains a complete list of lineman's and construction tools, all of which can be furnished from stock. Everyone interested in the construction of electric lines should have a copy, and the Western Electric company will mail one upon request to anyone desiring it. This pamphlet is known as Tool Catalogue No. 3.

Always alert and energetic, the Warren Electric and Specialty company of Warren, O., the "anti-trust" incandescent lamp maker, is now rallying its friends to aid it in selecting a name for its lamp. It explains that the name "Warren" has led to some confusion in the electrical business, and so it wants a new name. "It has seemed fitting to us that our patrons should decide this matter for us," says the company, "and in order to make the matter of sufficient interest to them to induce them to do so, we offer prizes for the best and most appropriate name as follows: First prize for the name which the judges decide is the best and most appropriate, $50 cash; second best, $30; third best, $20; fourth best, $10. Blanks will be furnished to be filled out and sent to us. The contest will be open from May 1st to November 1st, next, at which time a decision will be rendered and each contestant will be notified of the result, and checks sent to the successful ones."

BUSINESS.

Recent circulars of the Walker company relate to switchboards for isolated plants, the Walker underground electric railway conduit, Walker pivotal trolley and railway switchboards.

The Illinois Electric company, Chicago, desires to inform the trade that it has a complete line of Crefeld weatherproof, annunciator, office and magnet wires and is in position to fill orders promptly.

The Whitin Machine company of Whitinsville, Mass., has just completed a new casting shop which will be entirely fireproof. It is furnished by the Berlin Iron Bridge company of East Berlin, Conn.

Huebel & Manger of Brooklyn are kept busy getting out rush orders from all parts of the country. The outlook is very promising, and they expect to sell more bells and push buttons this year than ever before.

The Westinghouse company calls attention to its alternating-current fan motors for the season of 1898. These are induction motors, well finished, and made for 50 or 100-volt circuits and 7,200 or 16,000 alternations per minute.

The La Porte Telephone company of La Porte, Ind., has just installed a 300-line Stromberg-Carlson rapid-operating switchboard and completely changed from automatic to a manual system. It is said that greatly improved service has resulted from the change and that it is giving the company many new subscribers.

"A magnificent new train, and one that is ahead of any ever built." Such is the comment of people who have seen the New Pennsylvania Limited which leaves Chicago Union Station daily, at 5:30 p. m., over Pennsylvania Short Lines. H. R. Dering, assistant general passenger agent, 248 South Clark street, Chicago, gives details.

J. H. Cooke, 753 Monadnock building, Chicago, reports a lively inquiry for and many sales of the Jandus enclosed alternating arc lamp. Steady burning, high efficiency and absolutely noiseless operation are qualities that attract the central-station managers. Special information, prices and catalogues are sent on application.

The Westinghouse Electric and Manufacturing company has sold to the Citizen' Street Railway company of Indianapolis a 500-kilowatt machine of the Westinghouse standard type. The machine is direct-connected to an Allis Corliss engine and makes 90 revolutions per minute. It is over compounded 10 per cent., the normal potential being 550 volts.

The Empire Lamp Works, manufacturers of miniature electric lamps, announce the removal of their factory and office from 154 West Twenty-seventh street, New York city, to 124 Monticello avenue, Jersey City. The new quarters can be easily reached by way of the Pennsylvania ferries from Cortlandt, Desbrosses and Twenty-fourth street ferries to Jersey City, and thence by the Monticello avenue trolley cars, right to the door, a ride of 15 minutes from the ferry.

The American Tool Works company of Cincinnati, O., reports that the demand for machinery in foreign countries is still steady, notwithstanding the fact that hostilities between this country and Spain have begun. The company has received a number of orders through its London office, among them being one from J. Stone & Co. of Deptford, England, for a line of brass-working machinery, including valve milling machines, monitor lathes and cock grinders; also an order from Furnival & Co. of Raddish, England, for a number of standard engine lathes, drill presses and shapers.

The new air-tight open-circuit battery called the Badt hermetic cell is receiving the approbation of all engineers and electricians who have been obliged to deal with the troublesome question of primary batteries. The oil seal, which so positively prevents the evaporation of the liquid, the creeping of salts and the constant premature disintegration of zincs, is the latest novelty in batteries and is a feature which strongly recommends this cell for use. The Western Electric company of Chicago, which recently announced that it was headquarters for batteries of various kinds, desires to state that the Badt hermetic cell is also added to its list of batteries.

K. McLennan & Co., Chicago, sole manufacturers of the well-known Gale commutator compound, have found it necessary to remove to larger and more commodious quarters, owing to the increased demand for their product. This compound, it is said, is now in use not only all over the United States, but in every foreign civilized country as well. The compound is said to give entire satisfaction, and this accounts for its great demand. The success of the company is due in no small measure to the able management of Martin J. Isaacs, whose aim it has been to make Gale's commutator compound known all over the world. That he has succeeded is evident from the fact that orders are received daily from all over the world. The McLennan company is now located in a fine suite of rooms in the Title and Trust building, 100 Washington street. The company has heretofore been located at 1128 Marquette building.

Seventy-six double equipments of type 49 35 horse power motors have been ordered from the Westinghouse Electric and Manufacturing company by the Cleveland Electric Street Railway company. Westinghouse street-railway motors have achieved a degree of success that has made them standard. Charles H. Smith, superintendent of the Lebanon and Annville (Pa.) Street Railway company, writes: "On June 20, 1895, one of the Westinghouse 12-A 30 horse power equipments was put into service on this road. Since that time it has made 592 days, 200 miles a day, a total mileage of 118,400, without a single repair to any part of the machine, save renewal of brushes and bearings. The motors were put under a Jackson & Sharp 30-foot closed body car, running over the hardest part of our road, with less than five minutes' lay-over at either terminal from six a. m. to 12 midnight. We wish all our equipments were Westinghouse 12-A."

ILLUSTRATED ELECTRICAL PATENT RECORD.

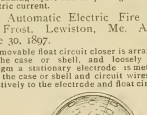
Issued May 3, 1898

603,263. Process of and Apparatus for Electrolytic Tanning. Edward Davis, Philadelphia, Pa., and Horace R. Mustard, Smyrna, Del. Application filed July 27, 1896.

In the art of electrolytic tanning the process consists in, first, purifying water by electrolysis, then bleaching with the water, then electrolyzing the tanning liquor obtained from leaching, then suspending the skins to be tanned in the tanning liquor and subjecting them to the action of an electric current.

603,270. Automatic Electric Fire Alarm. Walter E. Frost, Lewiston, Me. Application filed June 30, 1897.

A movable float circuit closer is arranged centrally within the case or shell, and loosely supported on diaphragm a stationary electrode is metallically connected with the case or shell and circuit wires are connected respectively to the electrode and float circuit closer.



No. 603,270.

603,283. Electric Arc Lamp. Timothy H. Pettengill, Amsterdam, N. Y. Application filed September 7, 1897.

Included in this combination with the coarse and fine wire coils, the starting coil, bridge contacts and circuit connections, are the armature lever, an insulated cut-out contact carried thereby, a circuit connection from the contact to the terminal of the coarse coil adjacent to the bridge contacts, and a short-circuiting contact against which the first-named contact is drawn when the armature lever is brought to its lowest position.

603,286. Electroplating Apparatus. Louis Potthoff, Flushing, N. Y. Application filed April 22, 1897.

This apparatus is intended for electroplating wire, and comprises a framework carrying rollers, a conducting comb carried by the framework for conducting current from the wire-can I for maintaining separate terms of the wire apart, a vat containing the frame-work, comb and rollers, one or more anodes contained in the vat, and circuit connections to the anode or anodes and comb.

603,334. Electrical Attachment for Gas Lights. Franklin L. Kellner and George S. Barrows, Philadelphia, Pa. Application filed November 22, 1897.

This attachment is particularly adapted for Welsbach lights. A valve is provided with a gaway and adapted to be lifted and turned to position by a plate like armature is connected with the valve and electromagnets, and means for lifting, rotating and quickly dropping the valve are provided.

603,369. Electric Signal System. Louis C. Werner, Broad Brook, Conn. Application filed June 12, 1897.

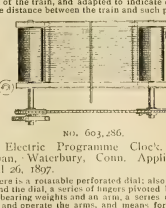
The conductor extending along the line of way is insulated from the track, and a current collector is provided which is automatically reversible, while in contact with the conductor, by the reverse movement of the vehicle, and comprises a carrier arm pivotally connected with the vehicle and a triangular sliding contact shoe pivoted to the carrier arm and reversible, on the reversal of the movements of the vehicle, to bring its different sides into engagement with the conductor

603,383. Electric Arc Lamp. Alfred W. Knutson, Galesburg, Ill. Application filed April 30, 1897.

A clutch for electric arc lamps having a clutch arm provided with a rod opening, and a movable auxiliary grip-jaw supported on the arm and normally moved in an inward direction, is one of the features described.

603,390. Electric Signal System. Louis C. Werner, Broad Brook, Conn. Application filed June 17, 1897.

A visual electrical indicator is carried by the train and in circuit with the current collector and responsive to every variation in the length, and hence in the resistance, of the conductor between the vehicle and the distant points within the range of the indicator, and having an indicator hand movable at either side of a normal, idle, central position in accordance with the direction of movement of the train, and adapted to indicate every variation in the distance between the train and such point.



No. 603,286.

603,450. Electric Programme Clock. James O. Lyman, Waterbury, Conn. Application filed April 26, 1897.

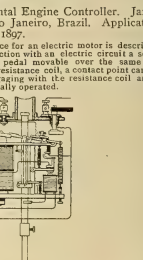
There is a rotatable perforated dial; also a contact plate behind the dial, a series of fingers pivoted below the dial, and bearing weights and an arm, a series of cams to engage and operate the arms, and means for intermittently rotating the cams to successively lower and raise the fingers.

603,515. Electrical Apparatus. William Stanley, Pittsfield, Mass., assignor to the Stanley Instrument company of Massachusetts. Application filed January 28, 1897.

Two coils are in series with each other and with a source of alternating current, in combination with two shunts, one of less, the other of greater time constant than the coils which they respectively shunt, and a closed-circuited armature is in direct inductive relation to the fluxes produced by both coils.

603,524. Electric Dental Engine Controller. James J. Coachman, Rio Janeiro, Brazil. Application filed August 21, 1897.

A controlling device for an electric motor is described, comprising in connection with an electric circuit a series of contact strips, a pedal movable over the same and carrying contacts, a resistance coil, a contact point carried by the pedal for engaging with the resistance coil and a pole changer electrically operated.



No. 603,284.

603,534. Time Limit Cut-out. Henry H. Cutler, Chicago, Ill. Application filed July 26, 1897.

One claim is given in combination with a motive coil of a cut-out and a time limit controlling the same and comprising a section of an electric circuit the resistance of which varies with rise of temperature due to the current.

603,606. Electric Conveying System. Alvaro S. Krotz, Springfield, Ohio. Application filed December 2, 1897.

The combination is claimed of a battery or other source of electrical supply, track conductors, one connected with one pole of the latter, a plurality of terminals stationed along a continuous stretch of the other track conductor and all connected with the other pole of the battery, and automatically opening circuit closers to connect the terminals respectively with the latter track conductor.

Western Electrician.
EVERY SATURDAY.
Vol. XXII. CHICAGO, MAY 21, 1898. No. 21

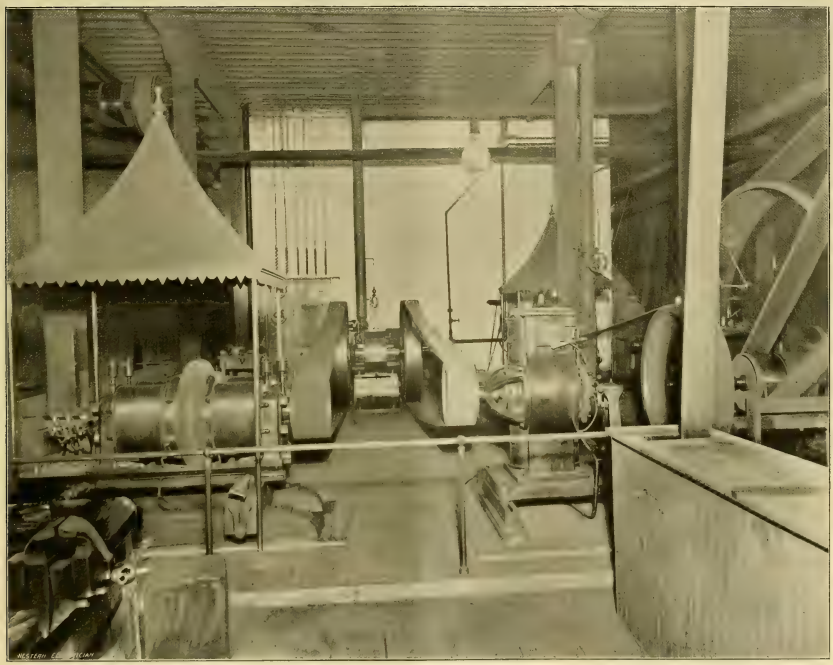
Lighting Plant in Railway Shop.

An interesting feature of the equipment of the mechanical department of the Chicago City Railway company is the electric plant which furnishes current temporarily for lighting the building on Dearborn street, between Twentieth and Twenty-first streets. The plant is of the conventional type, and, so far as the generators are concerned, presents no novel features. They are old-style machines, which were pressed into service, pending the extension of the mains from the big power houses to the downtown district. But they disprove many of the statements that have been made by makers of later machines, who contend that old types of apparatus are necessarily inefficient and unreliable. For the service required the plant at the City railway shops is admirably adapted and is certainly satisfactory to the company.

The picture on this page gives an excellent view of the machines. Two are dynamos are belted directly to a 75 horse power Ideal engine, made by A. L. Ide & Son of Springfield. One of these machines is an old Brush dynamo, shown at the left in the foreground of the picture. It carries 35 arc lamps and furnishes current at 2,500 volts. The Excelsior dynamo at the right, which is belted to the same engine, carries 40 lamps. The incandescent system is supplied from a Thomson-Houston dynamo, driven at 1,250 revolutions per minute, and furnishing current at 110 volts. This machine is in the background to the right and is partially hidden from view by the Excelsior dynamo. It is belted to a counter-shaft driven by a Jerome Wheelock engine which has a capacity of 125 horse power. The rest of the power produced by this engine is utilized in the shops.

The marble switchboard in the background contains the usual equipment of instruments. They are of the Standard Electric and Weston Instrument companies' make. A Brush current governor completes the equipment.

The lamps which are supplied with current from this plant are distributed throughout the shops. The incandescent lamps are mainly used in the pits and in the upholstering department, the arc lamps supplying the machine rooms. The plant was installed by the mechanical and electrical departments of the Chicago City Railway company last fall and has worked satisfactorily throughout the winter months.



LIGHTING PLANT IN RAILWAY SHOP.

New Electrically Lighted Trains on the St. Paul Road.

Two fine new limited trains have been built for the Chicago, Milwaukee and St. Paul Railway company and are about to be put into service between Chicago and St. Paul. The cars are electrically lighted, as might be expected from the pioneer railroad company in the West in the matter of electric train-lighting. A Westinghouse engine-dynamo is carried in the forward end of each baggage car, the steam being secured through a flexible coupling with the locomotive boiler. In addition an auxiliary storage battery is placed under each car, sufficient to supply a portion of the lamps for several hours in case of an emergency. The usual berth lights and ceiling clusters are provided, and in addition there are overhead lamps in the car vestibules. The ladies' toilet rooms are provided with electric curling-iron heaters.

Electrical Work in the Navy.

In the naval appropriation bill as passed by Congress and approved by the president are included the following items of electrical construction:

For repairing and improving the telephone line connecting the Navy Department and the Washington navy yard with the naval proving ground at Indian Head, to be immediately available, $10,000.

Addition to electric-light system at the Brooklyn navy yard, $15,000.

Steam generator for heating purposes and electric plant at the League Island navy yard, $5,500.

Improvement to the Washington navy yard electric plant, $16,000.

Toward the enlargement of the electric plant and concentration of steam at the Norfolk navy yard, $10,000.

Electric light and power plant at the naval station at Port Royal, South Carolina, $20,000.

Extension of the electric system at the Mare Island navy yard, $15,000.

Electric-light plant, Puget Sound naval station, $9,800. Establishing telegraphic communication at the same place, $4,000.

For the installation of electric-light plants in gunboats numbered 10, 11, 12 and 13, $40,000.

Wood Lake, Minn., is considering electric lighting.

National Electric Light Association.

A meeting of representatives of the electrical interests of Chicago was held at the Edison building, 139 Adams street, on Monday, May 18th, in response to an invitation from President Insull of the National Electric Light association. The following-named gentlemen were present: Messrs. S. Insull, O'Hara, Ferguson, Wallace, Donohoe, Wiley, Coster, Badt, Comstock, Munson, M. J. Insull, Wilmerding, Sunny, Low, Clark, Kittle, Gorton and Kammyer.

President Insull explained that the meeting had been called for the purpose of providing for the reception and entertainment of the visiting members of the National Electric Light association at the convention to be held in Chicago on June 7th, 8th and 9th. It had been decided, he said, to make the convention as much of a business meeting as possible, and for this purpose an excellent programme had been prepared. Among the special features for which arrangements had been made were the following:

PAPERS.

"Cost of Generation and Distribution of a Unit of Electricity." By Calvin W. Rice.

"General Distribution from Central Stations by Alternating Currents." By Herbert A. Wagner.

"General Distribution from Central Stations by Direct Currents." By Louis A. Ferguson.

"Public Lighting with Relation to Public Ownership or Control." By Alex Dow.

"Transformer Economy." By Winder Elwell Goldsborough.

"Cost of Producing Electric Power by Water Power from Lachine Rapids, Canada." By W. McLea Walbank.

TOPICS FOR DISCUSSION.

"Legislative Policy as to Public Service Corporations."

"Prices and Discounts for Electric Current, and Methods of Charging Customers."

"Standardizing Apparatus for Central Station Use."

"Standardizing Specifications for Incandescent Lamps."

"Freight Rates on Electrical Apparatus."

LECTURE.

"Electricity Direct from Coal." By Joseph Wetzler.

It was announced that the eastern delegation would reach Chicago on Monday, June 6th, and it was accordingly decided to hold an informal reception at the headquarters of the association in the Auditorium on Monday evening. It was thought that this would be an excellent way to have the visiting members meet the local central-station men and representatives of the allied interests.

Mr. Sunny suggested that a committee of 25 to be known as the reception committee, and to be composed of representatives of electrical interests in Chicago, be appointed for the purposes of receiving and entertaining the visiting members, and for the purpose of providing necessary funds for this purpose. This proposition met with general approval, and the following-named gentlemen were appointed for that purpose:

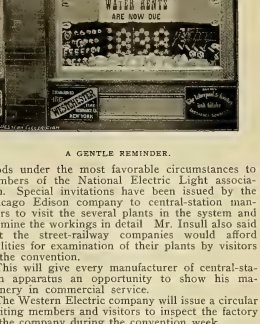
J. Holt Gates of the Walker company.
J. B. O'Hara of the Western Electrician.
L. A. Ferguson of the Chicago Edison company.
N. R. McLeod of Washburn & Moen Manufacturing company.
J. B. Wallace of the Wallace Electric company.
F. E. Donohoe of the American Electrical works.
J. R. Wiley of the Standard Underground Cable company.
M. Coster of the Westinghouse Electric and Manufacturing company.
F. B. Badt of Meysenburg & Badt.
L. K. Comstock of the Western Electric company.
Charles Munson of the Fort Wayne Electrical corporation.
M. J. Insull of the C. & C. Electric company.
F. W. Kohler of the Northern Electric company.
C. H. Wilmerding of the Crocker-Wheeler Electric company.
W. A. Kreidler of the Western Electrician.
W. H. McKinlock of the Metropolitan Electric company.
G. A. McKinlock of the Central Electric company.
B. E. Sunny of the General Electric company.
W. W. Low of the Electric Appliance company.
F. H. Clark of the Electric Storage Battery company.
Samuel Insull of the Chicago Edison company.
F. S. Gorton of the Chicago Edison company.
E. B. Kittle of the Sprague Electric company.
George C. Bailey of the J. A. Roebling's Sons company.
A. S. Hibbard of the Chicago Telephone company.
Mr. Wilmerding was elected chairman of this committee.

The chairman was authorized to appoint a committee of four to act with him as a finance and entertainment committee. This committee will report at a later meeting of the whole committee on a programme for entertainment and on ways and means. The chairman of the general committee, Mr. Wilmerding, appointed, as this committee, B. E. Sunny, M. Coster, J. B. Wallace and L. A. Ferguson.

John Jay Abbott of the Chicago Edison company was appointed secretary of the committee.

It was decided to meet again at the office of the Chicago Edison company, 139 Adams street, on Monday, May 23d, at 3 p. m.

Mr. Insull, on behalf of the Chicago Edison company, has extended a general invitation to manufacturers and agents having apparatus and supplies of any kind in use in the Edison system to invite friends and customers to inspect these products in actual operation. He said the company would gladly furnish facilities to others, and supply current for operation, in order that every manufacturer would have an opportunity of showing his goods under the most favorable circumstances to members of the National Electric Light association. Special invitations have been issued by the Chicago Edison company to central-station managers to visit the several plants in the system and examine the workings in detail. Mr. Insull also said that the street-railway companies would afford facilities for examination of their plants by visitors to the convention.



A GENTLE REMINDER.

This will give every manufacturer of central-station apparatus an opportunity to show his machinery in commercial service.

The Western Electric company will issue a circular inviting members and visitors to inspect the factory of the company during the convention week.

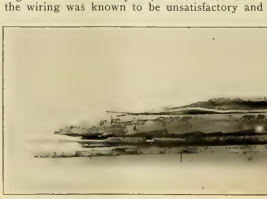
It is expected that there will be a large number of ladies in attendance at the convention, and for their special benefit there will be several trips in tally-ho coaches about the parks and boulevards of Chicago while the convention is in session. It is believed that this will prove an attraction to the ladies visiting the city at that time.

A. S. Hibbard of the Chicago Telephone company has placed the company's service at the disposal of the members of the association during the convention.

Electrical Fire at the Union League Club.

Electricity is made the scapegoat for many fires with which it has no connection, but there still remain too many cases of damage by fire due to some wiring defect. A case in point, where the condition of the wiring was known to be unsatisfactory and origin of electrical fires are usually destroyed. No trace of the annunciator wires was found near the place where the fire was started. It is believed that the fire smouldered for 24 hours before it was discovered. A toilet-room is near the location of the fire, and it is possible that a slight leakage of water was the ultimate cause of the short-circuit.

The building of the Union League Club contains an isolated electric-lighting plant that was installed about 10 years ago, when the art of interior wiring was comparatively crude. The plant is now being remodeled and rewired, but it was the irony of fate that the wireman had not quite reached the bad spot between the fourth and fifth floors at the time of the fire.


ELECTRICAL FIRE AT THE UNION LEAGUE CLUB.—BURNED-OUT MOULDING.

where a fire of clearly electrical origin ensued, was the fire at the Union League club-house in Chicago on May 13th. This fire was discovered at 11:30 a. m., and was extinguished by the firemen without great difficulty, not, however, until damage to the extent of about $2,000 had been done to woodwork, furniture and carpets. Investigation clearly revealed the fact that the trouble was caused by a cross between a 110-volt house-lighting circuit and annunciator wires in the space between the fourth and fifth stories of the building. The lighting circuit was of No. 14 wires, rubber-insulated and placed in a wooden moulding. The accompanying illustration shows the charred moulding and burned-out wires of the offending circuit as they appeared after the fire, showing where the arc occurred. It is interesting, because all traces of the

A Gentle Reminder.

In Chillicothe, Ill., the electric-light and water works are operated by one company, and like many other similar concerns it takes considerable pride in its establishment. It is customary to make a display in the company's window, and the brilliant illumination seldom fails to attract a crowd. During the month of April there was a particularly attractive display of electrical fixtures arranged artistically and a design with the figures 1898 picked out in incandescent lamps. The window itself was made to represent a frame and was studded with incandescent lamps. The manager of the company took advantage of the opportunity afforded to remind his fellow townsmen that a certain formality should be complied with in order to continue the service, so a sign was placed in a most conspicuous position (as shown in the picture) announcing that "Water Rents are Now Due."

The Inventor of the Telectroscope.

The Polish schoolmaster who is said to have invented an instrument by which one is enabled to see an object at a great distance by the electrical transmission of light-wave impulses has been interviewed. This instrument is said to do for light what the telephone does for sound. It has been considered a possibility by several inventors, and a number of experiments have been made to secure the desired result, but if the newspaper reports are true Szczepanik is the first to reach the goal. His instrument is known in English as the telectroscope. The Germans, with their patriotic preference for the home product in word building, call it the fernseher, or "far-seer." The interview referred to is printed in Black and White, an English weekly journal, and is interesting if not important:

My first impression of Szczepanik, as I met him at the house of his financier, Herr Ludwig Kleinberg, at Vienna, was that he could be anything but an inventor, though I don't suppose anyone has ever been able to detect an inventor by mere external appearance. He might be a struggling musician, a student or a shopman. I think my second was that there was a singular naïveté in this erstwhile village schoolmaster, who, just over the threshold of 25, had in a night sprung into fame. Szczepanik is of medium height and of sturdy build. His speech comes quickly, though his natural Polish volubility is somewhat curbed by the idiomatic difficulties which German presents to him. He gesticulated freely as he spoke, and paced up and down the room preferably to sitting. He wore an incongruous kind of dress of black—the usual continental compromise between evening dress and an English artisan's "Sunday best." His voice was soft, almost childish; his manners gentle and kind; but until one won his confidence his demeanor was reserved to the point of shyness. His modesty and bland simplicity are remarkable and irresistibly draw you to one of whom his financier remarked to me: "He is an unspoiled child of nature. He does not know his own greatness, and his modesty is charming."

Herr Kleinberg is said to have made the acquaintance of this gifted stripling casually in a Vienna cafe as he passed through that fitful "Sturm und Drang" period, destitute of everything but his wonderful ideas.

"You must be an incessant worker, Herr Szczepanik," I said to him.

"Yes, I am practically always at work, though it is only in the night that my mind can be said to be most fruitful. Do I miss my sleep? Not a bit! If an idea comes to me I must get up and clinch it, and I believe I alarm my friends by the enor-

mous number of cigarettes I consume in the nocturnal hours. My memory, however, works, as it were, on certain lines, and though I should never forget the details of a machine that I have once seen, I might easily forget an everyday incident where others could not possibly do so. I jot my ideas down in notebooks. My friends laugh at me about those books. I never know when an idea is going to strike me, and walking along the streets my companions are sometimes astonished to find that I have disappeared. What my particular sphere of inventive work is I cannot say. My mind is omnivorous. My invention which revolutionized silk-weaving was discovered, for instance, without my scarcely knowing what a weaving-loom was."

"How did you first discover yourself, so to say?"

"I don't know. I dabbled in invention as a child —made ships and whatever came to hand. My technical knowledge is almost all practical and acquired haphazard. It is true, I studied physics, but never gained any distinction, and I am afraid I made a good many enemies." He smiled reminiscently. "I used to spring problems upon the professors, even in my examination papers, and they didn't like it. Then I took up the subject of photography, and had the mortification of seeing several things patented which I had also invented. The finder in the kodak, that's one; the electrophonic piano, that's another. How did I hit upon the telectroscope? Oh, the idea is by no means a new one. My attention was first called to it by reading Professor Liesegang's 'Beiträge zum Problem des Elektrischen Fernsehens.' I hit upon the idea of employing oscillating mirrors. I do not say that my instrument is perfect. Was photography perfect, was the telephone or the telegraph perfect when first introduced to the public? Well, it must be relatively the same thing with the telectroscope. But I claim to be able to show a true picture of the object—be it a written-out telegram or a battle —with all the clearness of the cinematograph."

Szczepanik tacitly agreed with me that the effect of observation upon the mind of an inventor was to render him virtually a pessimist. He would see defects and shortcomings in everything which came within the range of his reflective powers. "I am myself a skeptic concerning physical forces," says Szczepanik. "For instance, I question sometimes whether color exists in nature. I believe the sensation of color is due to a certain condition associated with optics. Hence, I fear we shall never be able to obtain more than a limited success in color-photography, simply because, in my opinion, you can never more than relatively approach those conditions prevalent in the human eye. My aim in physics is simplicity, and to exclude the unnecessary and superfluous. Unfortunately, it takes years and years of this exclusive process before mankind has finally reached that goal which is perfection."

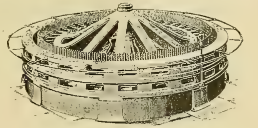
The English electrical papers insist that no material advancement has been made. The London Electrical Engineer, for instance, in its last issue, commented as follows: "Mr. Paul Schmidt gives in a Vienna paper further details of Herr Szczepanik's invention, with a diagram of connections which is unintelligible. The gist of the whole article lies in the last paragraph, which practically states that the inventor has abandoned selenium as unsatisfactory, and that he is experimenting on a more sensitive compound of his own. When this is a success more details will be given. We remember that the last time we prophesied that an inventor was stating his ideas as facts without first trying them, we were threatened with personal violence. In spite of this, we do not mind venturing the prophecy that so far Herr Szczepanik has carried out no successful experiment, but has confined his attention to romancing to untechnical reporters."

Fritz Koettiger of Fountain City, Wis., contemplates establishing an electric-light plant.

Electric Power Transmission at Bellegarde.

In 1871 an English-American syndicate obtained a franchise for exploiting the hydraulic power of the Rhone at Bellegarde, about 32 kilometers from Geneva, Switzerland, but the system of power transmitted by cables did not prove satisfactory, and electrical transmission has since been substituted to the advantage of all concerned.

The power-station is at the union of the Valserine and the Rhone. Immediately above Bellegarde the Rhone is quite narrow, being only from five to 20 meters in width, and its course for that distance is nearly straight, especially at the narrowest part. Formerly the river at this point became subterranean for a short distance, but in order to make a better and safer route for the water during freshets the overhead rocks were blasted away, and the Perte du Rhone is no longer a tourists' wonder. Here, at high water, the flow is about 1,275 cubic meters per second. The hydraulic canal commences immediately



800 Horse Power Alternator.

ELECTRIC POWER TRANSMISSION AT BELLEGARDE.

above the rapids and runs about 150 meters on the surface, having a width of 20 meters average and a depth of 2.5 meters, separated from the river by a dike of masonry. This is followed by a tunnel 550 meters long, excavated through a hard, chalky formation, having a width of nine meters at base and 6.5 meters depth, or 56 square meters of cross section.

Three gates at the entrance of the tunnel regulate the admission of water, which is afterward led to a reservoir of 1,500 cubic meters capacity, at the rear of the station, where it passes the turbines and returns to the river.

The maximum volume of water which passes through the tunnel is 100 cubic meters per second. The fall is 12 meters at the turbines at low water, and from 11 to 10 meters at mean and maximum flood. Assuming 75 per cent. efficiency for the turbines, the efficiency at the driving axles would be as follows:

	Volume.	Fall.	Power.
Low water.	60 cubic meters	12 m	7,200 H. P.
Mean water	80 " "	11 m	8,800 "
High water..............	100 " "	10 m	10,000 "

In view of the possible changes in the bed of the river, it is intended to build a wing dam to turn more water into the canal in case of necessity.

The station originally included three turbines, having a total of 2,000 horse power—two of 600 each and one of 800. One is 2.5 meters in diameter, making 90 revolutions per minute, and the others are now making 130 revolutions, being direct-connected to triphase alternators.

Of these alternators one has a capacity of 800 horse power. The field of 44 poles is mounted on a steel wheel cast in one piece, 3.85 meters in diameter. The armature is carried on a fixed crown, and has a diameter of 4.6 meters. The total weight of the machine is about 22 tons, or nearly 40 kilogrammes per kilowatt, for the output is 400 amperes at 1,050 volts. The frequency is $47\frac{1}{2}$ periods, and the efficiency 95 per cent. The exciter is a 20-kilowatt machine, actuated by a separate turbine, and absorbs about 3.5 per cent. of the power. Considering the fact that the original installation of turbines was not thoroughly the best for the present purpose, these figures are not excessive in the present adaptation.

Two new dynamos have been installed of 1,200 horse power each, direct-connected on the turbines. The station is sufficiently large to admit of further additions to raise the total to 8,000 horse power. A 15-ton traveling crane is also in contemplation as part of the station equipment. Arrangements have been made so that, with three separate superposed wheels and automatic regulation, the best advantage can be taken of the various heads of water. The diameter of these wheels is three meters, the speed 114 revolutions and the efficiency 75 per cent.

The two 1,200 horse power dynamos have each an exterior diameter of six meters and the inner moving part of five meters. The capacity is 350 amperes at 2,000 volts, and the total weight is 42 tons. The installation is completely protected by lightning arresters, a very necessary precaution in that stormy, mountainous region.

The distribution of the energy developed in the initial plant is interesting, as the table herewith shows:

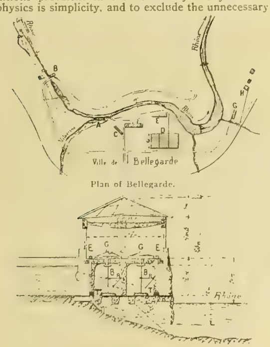
	Distance of transmission	H. P. delivered	No. of motors.
Phosphate of lime mills ...	[illegible] meters	200	3
Phosphate of lime mills......	[illegible]	90	2
Cotton mill	[illegible]	[illegible]	3
"Batiste" fiber mill ...	[illegible]	250	[illegible]
Paper mill........	200 "	120	cable transm.
Calcium carbide works	[illegible]	[illegible]	1
Saw works	[illegible]	[illegible]	[illegible]
Total	[illegible] meters	[illegible]	

To deliver 2,500 horse power from the dynamos it is necessary to develop 3,200 horse power at the turbines, 2,000 of which can be furnished by the old cable transmission system. The mean loss is eight per cent. in the alternators, four per cent. in electric transmission and eight per cent. in the motors, a total of 20 per cent., as against 30 per cent. in cable transmission.

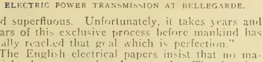
One of the most interesting of the installations in this system is that which furnishes power for operating a cotton mill. One floor contains the looms and the triphase motors, these latter being well removed from dust and housed in a separate apartment. Three motors are used, one to run the fan and the machine shop, while the others drive the shafts. One of the pair runs the preparatory machinery, carders, combers and spoolers; the other operates the looms. These two motors absorb 80 amperes at 1,000 volts, make 350 revolutions and are self-regulating between 120 and 170 horse power. The first consumes between 15 and 30 horse power.

Through the medium of a transformer current is furnished for 360 lamps of 16 candle power, 300 of which are in the spinning loft.

The price charged for current varies with consumption, from 100 to 50 francs per horse power year. The power is available 7,500 hours per annum, the continuous user paying from 0.67 to 1.33 centimes per horse power hour. If power is used at the rate of 11 hours for 300 days, the price is greater.

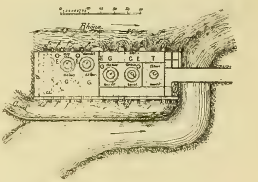


Plan of Bellegarde.

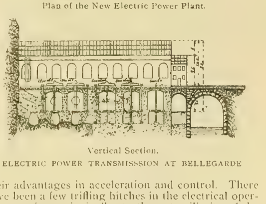


Old Mechanical Power Plant.

ELECTRIC POWER TRANSMISSION AT BELLEGARDE.



Plan of the New Electric Power Plant.



Vertical Section.

ELECTRIC POWER TRANSMISSION AT BELLEGARDE

Alley "L" Electrically Operated.

On Monday 52 of the cars of the South Side Elevated Railway company, Chicago, were electrically operated. These cars are supplied with current from the company's power house at Fortieth and State streets, now nearly completed, and are run in trains composed of from two to five cars. Each car has its own contact shoes, motors and controlling apparatus, but all the cars in a train are operated from the head car (although the motorman could control the train from any car) by Frank Sprague's multiple-unit system of control. The electrical trains are interspersed among trains drawn by the old steam locomotives, and the train service is consequently partly steam and partly electric and will continue to be such for a short time, with a gradually decreasing number of steam trains, until all the cars are electrically equipped and the last steam locomotive is withdrawn from the road. The time schedule remains as arranged for the steam service, of course, while the steam trains are in operation, but the electric trains can make better time, owing to their advantages in acceleration and control. There have been a few trifling hitches in the electrical operation, owing, principally, to the unfamiliarity of the train crews with the new system, but, on the whole, the success of the Sprague system has been demonstrated. In response to the inquiry of a representative of the Western Electrician, General Manager Hopkins of the South Side company said that the electrical train operation had proved "very satisfactory indeed."

The council of Algona, Ia., is considering granting a franchise to a private concern to put in an electric-light plant, or forming a stock company of local capitalists who will put in such a plant for the city, to be operated in connection with the water-works.

Mayor Truelson of Duluth, Minn., thinks the plant of the Hartman Electric company to be worth only about $100,000, which he would be willing, on the part of the city, to pay for it. He says that if the Hartman company does not care to sell he is in favor of putting in a competing plant and making reasonable rates.

The Trimming and Cleaning of Enclosed Arc Lamps.

By J. H. Hallberg.

The trimming and cleaning of the inner globes of enclosed arc lamps is of the utmost importance, as the efficiency or candle power depends, to a large extent, on the transparency of the inner globe. It is a serious matter and well worthy of careful consideration. I wish to suggest a system for doing this work, which will save many inner globes, "kicks" from customers, carbons and labor. It may be applied to any sized plant.

The following suggestions are based on the claim that one set of 12 by ½ inch solid carbons will burn from 125 to 150 hours and apply to all enclosed arcs except the alternating, in which is used various sizes of carbons, some lamps using one solid and one cored, others two cored carbons, and there may be alternating-current lamps that use solid carbons in both top and bottom, but as yet they are not advertised in this country.

Let us suppose that I am the manager of a lighting plant, and a number of enclosed arcs have been put in service for either commercial or street lighting, and that I am to get up a system of trimming and cleaning these lamps. I would proceed as follows:

First, I would make a box of tin or zinc about 18 inches long by 13 inches wide by six inches high and space it off so I would get room for 12 inner globes, 25 or more upper carbons, 25 or more lower carbons, 25 stubs of carbons left in upper holder after 125 to 150 hours' run, 25 stubs of burned-out lower carbons and one space for a few small repair tools and bolts for wiping.

I would cover the inside (bottom) with one-sixteenth-inch thick asbestos, which will prevent the chipping or breaking of the inner globes when they are placed in their spaces. I would attach a strong strap to this case for carrying, and get an oil-cloth, or something similar, to cover the globes and carbons in rainy weather, as dampness on carbons and inner globes has a bad effect on enclosed arc lamps.

Then I would buy one extra inner globe for each lamp, as many carbons as I would need for one year and a few screws, etc., that are liable to get lost or damaged during burning or trimming. When the time came for retrimming the lamps, I would place 12 clean inner globes in their respective spaces in the box, leaving the thirteenth space empty, 25 upper and 25 lower carbons in their spaces, and a few of the small screws, etc., with tools and cloths in their space. Now all spaces but three in the box are filled. I put on a pair of gloves, pick up my box and ladder and start to trim.

First, shut off the current, then lower outer globe, take out dirty inner globe, place the latter in the thirteenth space in the box, remove carbons left in upper and lower holder, and place them in their respective spaces, place new upper carbon in its holder (firmly) and try it up and down slowly to insure against binding, place new lower carbon in its holder, being sure no broken piece is left in bottom and that carbon is down as far as it should go, put on clean inner globe and lift clutch up so as to see everything works right.

Take a cloth and wipe any part of lamp that may be dusty or dirty and reach down and wipe out the outer globe, as there is always more or less dust accumulated in it, either from the outside or from the arc enclosed in the inner globe. Now I would set the outer globe in its support and wipe it on the outside and turn on the switch. In a properly designed lamp the trimming should not take over three to five minutes. After trimming 12 lamps I would get a fresh supply of inner globes and carbons, leaving the old ones in the station. This would be continued until all my lamps were trimmed.

After trimming I will have a number of burned top and bottom carbons and dirty inner globes. I will first proceed to cut the carbon pieces left in upper holders for the lower holders at the next trimming. I would make a simple gauge of some metal the exact length marked on tag of lamp, and cut my carbons with a hack-saw or a pair of shears, which I prefer, to this gauge, always taking care to get the size within one-sixteenth inch. This exact size is of much importance.

My next move will be to clean the dirty inner globes. In looking them over I will find most of them are covered with a gray-white dust or film on the inside, which comes off if the globe is washed in clean water; but I will also find some that show a brownish stain around the top of the globe which apparently will not come off after they are washed in water, no matter how much it is washed. The most common cause of this is impure carbons, which contain too great a proportion of metallic substances, or it may be caused by the lower carbon being too long, which in turn brings the arc too near the neck of inner globe, or possibly there is too much current flowing across the arc, especially during the few minutes after trimming lamp with new carbons, which causes an excessive flame that gets in contact with the globe and in that way stains it.

There is no new knowledge only one way to clean a globe in this condition and that is by dipping the burned part in hydrofluoric acid. This acid is very dangerous to handle, and much care should be exercised when it is used. As this acid will eat through almost every material except lead and wax, it must be kept in a jar of that material. I prefer lead, as the wood gets worn with it acting on the glass, and I have seen cases where the wax melted and let the acid run out.

I will now construct a round lead vessel about six inches high by 3½ inches in diameter (inside). I would make this out of an ordinary lead pipe about 2½ inches diameter. After cutting it off, I would set it in clay or something similar, and pour melted lead in the bottom so as to form a bottom-side about one-half inch thick. Be sure it makes a good tight joint. You must not solder this bottom as the acid will eat out the solder. Now I will buy one pint of hydrofluoric acid and put enough in this lead vessel so that it will cover all but one-half inch of the inner globe when the latter is inserted. The hydrofluoric acid is put in specially prepared wax bottles and you must be careful when you handle them, especially in very warm places. If you get any acid promptly made with a view to the early resumption of dividends."

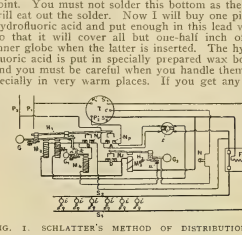


FIG. 1. SCHLATTER'S METHOD OF DISTRIBUTION OF ALTERNATE CURRENTS BY TRANSFORMERS.—PLAN OF CONNECTIONS FOR A SINGLE TRANSFORMER.

on your hands, it is well to wash them in water at once and apply pulverized soda or something similar. It is well to have something of that kind on hand at all times.

I will select a place for this cleaning where I can get a draught to carry off the gas fumes and if possible have constantly running water; if running water cannot be obtained, get two large tubs of clean water and boxes with perforated bottoms spaced off for about 25 globes each.

After selecting the stained globes, I put on a pair of rubber gloves and commence work. First, dip part of globe that is burned in the acid (this will only take about one or two seconds in ordinary cases), then give it a liberal bath in the first tub of water; now we may find a light white film on the globe which we wipe off with a cloth and then dip in the second tub of water. After this place it in the box with the perforated bottom; after your box is full, take it to some warm place, say on top of a radiator, steam-pipe, boiler, etc. After an hour you will find your globes are as good as new, although some may need a little further cleaning with a cloth.

Some people advise, in place of using the acid the way above described, to use 10 parts of water to one part of acid, and place your globes in this bath. This method takes at least 10 minutes, and if several globes are in the bath at once your chance of breakage is greatly increased.

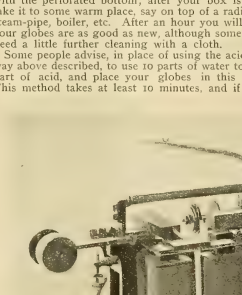


FIG. 3. SCHLATTER'S METHOD OF DISTRIBUTION OF ALTERNATE CURRENTS BY TRANSFORMERS.—PERSPECTIVE OF APPARATUS FOR A SINGLE TRANSFORMER.

General Electric Company.

The statement of the General Electric company for the last year has already been published. At the annual meeting of the stockholders of the company, which was held at Schenectady on May 10th, 210,000 shares were represented. The following directors were elected: Gordon Abbott, Boston; Oliver Ames, Boston; C. A. Coffin, New York; T. Jefferson Coolidge, Jr., Boston; C. H. Coster, New York; Thomas A. Edison, Orange, N. J.; George F. Gardner, Boston; Eugene Griffin, Ardsley Casino; F. S. Hastings, New York; Henry L. Higginson, Boston; J. Pierpont Morgan, New York; Robert Treat Paine, 2d, Boston, and George Foster Peabody of New York.

The following resolution was adopted: "Resolved, That the interests of the stockholders require that any proper or necessary adjustment of the impairment of the capital of the company should be

Schlatter's Method of Distribution of Alternate Currents by Transformers.

In practice, says l'Industrie Electrique, commenting on an article in Polytechnikai Szemle, transformers are seldom employed up to their full capacity. In fact the greater portion of these distributers are exclusively used in illumination, while comparatively few are used on motor circuits. Records of central stations show that the daily work accomplished by these distributers of energy average only about two hours of full-load service. From this data the following table of efficiency was worked out by Ganz & Co.:

Transformer of 10	kilowatts.....	efficiency 0.75
Transformer of 5	kilowatts.....	efficiency 0.692
Transformer of 2.5	kilowatts.....	efficiency 0.652
Transformer of 1	kilowatt	efficiency 0.515

Among the methods suggested for reducing the waste of current is the Schlatter method of cutting out the idle transformers. The apparatus employed is designed for single transformers or for a battery of them.

Figs. 1 and 3 represent the first form. P1 and P2 are the primary conductors, S1 and S2 secondary conductors, T the transformer and t a small auxiliary transformer of which the primary and secondary windings are in series with the corresponding windings of the transformer T. M1, M2 and M3 are the electromagnets, which, having different windings, have consequently different self-inductions. The armatures of these electromagnets are fixed on levers H1 and H2, which also support the forked links which dip in the mercury cups A, B and D, while n k is an escapement, G, G1, G2 are counter-weights, N is an incandescent lamp in circuit with the magnet M4, c is an intermediate terminal on the transformer T, say of 50 volts, and F is the meter shunt. The lamps and other apparatus fed are represented by i.

The transformer is not completely cut off when idle, but the combinations effects a reduction of about 95 per cent. of the loss, because of the almost complete transfer of this to the smaller transformer t. For this purpose the latter has but a small primary winding, so that the greater portion of the waste is absorbed by the auxiliary transformer. If a lamp i is put in circuit, the two transformers, T and t, being in series, will furnish the necessary current, which will pass through M1, energizing it and tip the lever H1. The forks will drop into the mercury cups, completing the circuit from t through its primary via A, and through its secondary and M1 via B. T is now in service, and H1 remains held down by M2, this last being energized by the current feeding the lamps i, and is only restored to its normal condition of repose when this current is cut off. The track of this secondary current is as follows: t S2 i S1 T M3 M1 t, when idle, and when under a load T S1 i S2 B M2 M3 T.

The apparatus with some modifications is equally applicable to a battery of transformers. This arrangement includes electromagnets capable of drawing down their respective armature levers with any current for which they are adjusted, and thus adding a new transformer to those already in action.

This process seemed feasible enough, but experience showed that when the first lever was tipped the second transformer was placed in branch circuit, and consequently each transformer delivered a certain amount of current; the first lever then commenced a series of vibrations, which, in addition to wearing out the apparatus, had a weakening and fluctuating result on the candle power of the lamps on the secondary. To remedy this defect a glass tube inclosing mercury has been attached to the lever over the center of motion, which retards this latter, and when the lever is fully open holds it in that position.

New York Electrical Society.

The 187th meeting of the New York Electrical society was an important event in the history of that organization. It was held at Concert Hall, Madison Square Garden, on Thursday evening, May 12th, in conjunction with the electrical exhibition. The society added 103 names to its list of members, including some notable men of the metropolis. Most of the new members are residents of New York, but there were many outsiders admitted. Following is the list:

Ernest B. Laclain, C. C. Bohn, W. G. Ames, E. M. Saules, Frank A. Wunder, Albin Gustafson, Charles J. Klein, Chester Bayles, James Jones, Jr., F. W. Becker, D. Levy, Richard M. Beard, E. A. Quick, Reinhold H. Wappler, Edward Hyans, George M. Loos, P. H. Klein, E. R. French, J. B. Sayles, James H. Spencer, J. D. Gould, Charles A. Hanson, C. W. Price, Lucien W. Jenney, P. M. Mourey, Walter S. Levin, Benjamin O. Ellis, H. D. C. Richards, C. B. Sterling, D. S. Holcomb, Charles E. Dressler, M. C. Rorty, Charles W. Hoffman, Willard S. Bennett, Charles Fred, Many Fred, A. H. Mustard, Harold A. Tileston, Oscar F. Ehrle, William Aus, Elias E. Ries, W. J. Newton, John Burry, Thomas S. Jamieson, S. Clark Harris, R. J. Halligan, V. J. Mayo, T. W. Kloman, Warren A. Brown, Harry Hilbert Conner, Hugo Gotfreund, A. S. Brown, J. Henry Gill, Daniel Von Wien, M. Cushner, John Jacob Astor, Mortimer Norden, Chauncey M. Depew, L. W. Hildberg, Samuel B. Brewster, George Pugh, Emil Finger, Joseph Solot, Charles Penina, Francis Gans, Gottfried Gans, Howard D. Black, William Wilson, Lighthipe, W. M. Logan, Joseph B. Curran, Jr., E. R. Esmond, John McLean, Frank W. Hawley, Cyrus O. Baker, A. O. Schoonmaker, W. C. Burton, R. Hoyt and J. E. McConnell of New York.

H. Krantz, Joseph Albaum, Solomon S. Sugar,

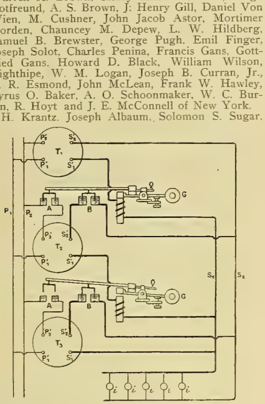


FIG. 2. SCHLATTER'S METHOD OF DISTRIBUTION OF ALTERNATE CURRENTS BY TRANSFORMERS —PLAN OF CONNECTIONS FOR A BATTERY OF TRANSFORMERS.

A. T. S. Clarke, Frederick W. Schnelle, A. T. Welch and John O. Lott of Brooklyn.

Harry Hunter, Far Rockaway, N. Y.

E. T. Schoonmaker, Fordham, N. Y.

E. N. Corbin, Walton, N. Y.

Charles R. Barnes, Rochester, N. Y.

J. Henry Gill and Charles H. George, Orange, N. J.

James MacMaster, Elizabeth, N. J.

William Darrow, Jr., Summit, N. J.

W. D. Macdonald, Hudson Heights, N. J.

Fred E. Dolbear, Elizabeth, N. J.

W. M. Allen, New Brunswick, N. J.

J. C. Jones, Ampere, N. J.

G. R. Berger, Newark, N. J.

Frank M. Tait, Catasauqua, Pa.

F. L. Meyer, Philadelphia, Pa.

Garret A. Hobart, Jr., Washington, D. C.

George W. Vanderbilt, Asheville, N. C.

M. J. Wightman, New Brighton, S. I.

The society received many congratulations upon this evidence of prosperity and the evident appreciation that was shown for its work.

Dr. S. S. Wheeler, the president of the society, delivered an interesting lecture upon "Electrically Driven Machinery," which was profusely illustrated. The address was of a popular character, and in the course of his remarks Dr. Wheeler said:

It is evident, from the rapidity with which electric motors have been introduced, that their advantage must be very marked.

First, they are capable of direct connection to the machinery to be operated, which means that their power, however great it may be and however large the machine, can be transmitted by the shaft instead of requiring a cumbersome belt and a pulley on the driven machine large enough to receive by the friction of the belt traveling upon it the needed power. As 1,000 feet of belting one inch wide must pass around a pulley in a minute to transmit one horse power, it is evident that the handling of 100 horse power will require a large pulley and a heavy belt, which is not only inconvenient and sometimes dangerous, but occupies considerable floor space and requires that the machine be heavy enough in design to support the large pulley and the strain of the belt.

Second, motors are capable of regulation and control of their speed and driving power with great convenience, so that electrically driven machines can be started, stopped, reversed or speeded up by the use of small instruments known generally as "regulators," which may be placed close to the machine or in any other convenient location, while machinery driven by belting can be merely started or stopped and then only with a considerable manual effort in shifting the belt, or can be run at other speeds only by bodily removing the belt to a driving pulley of different size.

Third, motors, when used for driving machinery, are usually attached directly to the machine, and being much less bulky than other means of driving, the entire machine is independent of any line shafting, and therefore may be located in a convenient position without regard to this limitation, and in many cases can even be picked up and shifted from one place to another, as the exigencies of work require.

Fourth, electricity permits the saving of one half to two-thirds the power otherwise required. This results from the fact that when the tool is stopped the motor is stopped and draws no power, whereas, in belt-driving, when the tool is stopped the belt or one of the belts is simply shifted and continues to run on an idle pulley.

And last, electricity presents an enormous advantage in the transmission of power.

Electrical Equipment for the Conkey Printing Establishment.

The contracts for the electrical and mechanical plant for the printing establishment of the W. B. Conkey company in Hammond, Ind., have been let as follows:

Boilers.—Standard Boiler company, Chicago. (Two water-tube boilers of a steaming capacity of about 175 horse power will be installed.)

Engine.—Atlas Engine Works, Indianapolis. (One Corliss engine of 150 horse power.)

Generator.—Siemens & Halske Electric company, Chicago. (The generator will be a 220-volt, 100 kilowatt, direct-current machine, directly connected to the engine. The Arnold system of connection between engine and dynamo will be used.)

Motors.—Sprague Electric company, New York. (No less than 72 motors will be required, ranging from ½ to 25 horse power. About 40 motors will be direct-connected to printing presses.)

Heating system.—B. F. Sturtevant company, Boston.

The Conkey company is a Chicago concern, but will have its plant at Hammond. The new building will be 400 feet square and will cover an area of nearly two acres. It will be only one story high, and with especially arranged skylights the whole interior of the large building will be literally "as light as day." All the machinery in the plant will be electrically driven, and the smaller machines will be arranged in groups, with one motor for each. The power and heating plant will be housed in a separate building. The lights and motors will be wired on the same circuits, and 220-volt lamps will be used. B. J. Arnold is the electrical engineer.

Electrocution in Ohio.

Cincinnati, O., May 14.—The electrocution of Frank Early, the Cincinnati wife murderer, in the Ohio penitentiary early this morning, was a horrible spectacle. Early was the first negro to die in the electric chair. Warden Coffin had his misgivings and a couple of hours before the final scene the prison barber was sent to the death chamber with orders to shave the top of Early's head, so as to allow no interference with the electric current. To this operation Early quietly submitted.

When the fatal moment arrived he walked to the chair without support. Two minutes after he sat down all but his head was made fast, the sponge and death mask were fitted, and at 12.15 the hum of the apparatus told that the current had struck him. Three times a current of 1,000 volts was shot through the prisoner. The doctors pronounced him dead at 12.17.

The straps were half removed, when the giant chest moved and groan after groan came from the foaming mouth. "He is dead," said the doctors. "He is not dead," shouted somebody else. Warden Coffin ordered the negro strapped again, and again the body stood rigid under the current. A deep groan answered this shock. Another shock and smoke rose from the right ankle. The third shock at 12.21 was not answered, and so with six shocks and seven distinct groans Early was dead 330 seconds after the first current entered his body. After the body was laid in the corner the doctors wanted to hold a post-mortem examination to see whether the man had died from the first shock, but the relatives would not permit it.

International Electrical Notes.

Russia.—It will be necessary to make a very strong effort to gain a foothold, as the prospects are encouraging. The Russian market is just beginning to show a demand for electrical apparatus, and it will soon develop into a vast field for trade, with which the home industry will not be able to cope.

The municipality of Warsaw is prepared to receive tenders for supplying the town with electric power for lighting and street-railway work.

Australia.—During the last session of Parliament in South Australia an act was passed in favor of the South Australian Electric Light and Motive Power company, which gave to the company practically a monopoly of the electric-light and motive-power business throughout the colony. One of the promoters of the bill was Mr. W. W. Crawford, the representative in Australia of Johnson & Phillips, to whom orders for the Port Adelaide plant have already been transmitted.

Japan.—A water power and electric-light company has been projected by Messrs. Konishi and Shimanoo and other gentlemen in Settsu, the scheme being to utilize a waterfall in Arima of the same province. The object of the company is to introduce electric lighting into the neighboring towns of Nada, Mikage, Nishinomiya, Itami and Amagasaki, and at the same time to build an electric railway between Arima and Mikage.

Sweden.—About 160 kilometers (99 miles) from the Swedish capital there is situated the celebrated waterfall of Elfkarleby, which is the property of

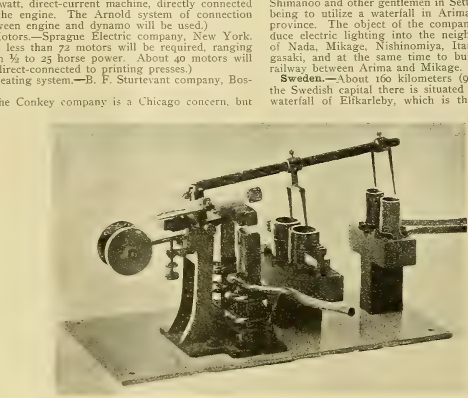


FIG. 4. SCHLATTER'S METHOD OF DISTRIBUTION OF ALTERNATE CURRENTS BY TRANSFORMERS —PERSPECTIVE OF APPARATUS FOR A BATTERY OF TRANSFORMERS.

the government and, at an average height of water, represents about 100,000 horse power. For a long time it has been planned to utilize this enormous power for Stockholm, and during the last few months practical steps have been taken by the government toward the scheme. Engineers have been ordered to thoroughly examine the conditions of the fall and draw up the plans. It is proposed to utilize 20,000 horse power. The total expenditure will amount to about $2,160,000. Orders for the machinery and supplies involved will be forthcoming at an early date, and American manufacturers should avail themselves of this opportunity.

South Africa.—An electric-lighting installation is under contemplation for the Monastery diamond mine, Orange Free State.

The provision of an electric-light installation for Woodstock, Cape Colony, is under consideration by the Town Council.

The proposed electric-lighting plant for East London will include 43 2,000 candle power arc lamps, 327 32 candle power incandescent lamps, 2,304 16 candle power incandescent lamps, five continuous-current machines for arc lighting, three direct-coupled alternators for the incandescent service, two switchboards and the usual supplies.

The decision of the directors of the Angelo-Driefontein mines to increase the mill power to 400 stamps will necessitate the installation of additional machinery.

H. L. G.

The building inspector of St. Paul has completed plans for the proposed electric-light plant, and estimates its cost at $200,000. The city clerk will probably take bids on the plans.

The electricians of Winona, Minn., have formed an organization, with H. B. Kline as president, M. McAllister as vice president, John McIne as secretary and Frank Wood treasurer. Meetings will be held every Saturday night.

The police of Des Moines have discovered about $100 worth of electric light fixtures in the possession of E. Gordon. The fixtures were stolen from the Capital City Electric Light company.

Western Electrician.

EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome, and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The principal event of the year in electrical circles is at hand. It is the annual meeting of the National Electric Light association, which will be held in Chicago on June 7th, 8th and 9th. The preparations for this convention are now far enough advanced to warrant the statements that it will be truly representative in character and that it will be attended by a larger number of central-station men than any previous gathering of the organization. The gentlemen in charge of the arrangements for the meeting have received personal assurances which warrant them in making these assertions.

But there are other reasons for anticipating a well-attended, instructive and profitable meeting. The general condition of the industry shows marked improvement, the electric-lighting companies of the country are in much better condition financially than they have been for several years, the association is stronger in membership and better organized than formerly and the inducements held out by Chicago are superior to those of any other city in the country for practical men. The local electrical interests are engaged in making arrangements for the entertainment of the members that will be thoroughly enjoyable, but will not interfere with the work of the convention.

The programme for the meeting includes several papers on subjects of interest to every central-station manager. There will also be a general discussion of several topics which are announced elsewhere in this issue. It was deemed advisable to present fewer papers than heretofore and have them properly discussed. Every practical man recognizes the value of open discussion, and it is hoped that the Chicago meeting will mark a turning point in the history of the National Electric Light association by establishing the rule of thoroughly discussing every paper that is presented. There is no doubt that the papers will contain much matter for discussion. The list of topics and names of the writers alone should ensure an interesting and successful meeting.

The London Electrical Engineer refers to Electrical Engineering of Chicago as "an American contemporary, at one time a staunch supporter of the independent telephone companies." It is evident that the self-appointed champion of the Bell interests has not made much of an impression abroad.

With some modifications the automatic telephone system with which American telephone managers are familiar is being introduced in England. At the present time, however, it would seem to be difficult to successfully introduce an independent system in England. The National company is in disfavor, but there appears to be no inclination on the part of the local authorities to encourage competition. In fact, the government discourages the establishment of competing corporations, and the general opinion seems to be that the solution will be found in the establishment of a telephone department in the Postoffice, which will control all the telephone business of the country. This ought to be fully in accord with English ideas, and will probably be satisfactory to the National company if it can get its price for the present equipment.

Industrial exhibitions have become so common that there is little in the way of novelty to be expected from them; indeed several of those that have been conducted of late follow the same general plan. This may be explained by the fact that these exhibitions were of a local character, and while many of them took on an air of importance and paraded under high sounding titles, their scope and character were limited. It is proposed now to start on an entirely new plan, and the committee on interstate and foreign commerce has recommended the passage of a bill by Congress to authorize and encourage the holding of a national exposition of American products and manufactures especially suited for export at Philadelphia in 1899. This exposition is to be held under the auspices of the Philadelphia Commercial Museum, which is a public institution, receiving financial support from the City Councils of Philadelphia and the state of Pennsylvania. This organization is devoted in a large measure to assisting in the development of foreign trade, and as its agents are in close touch with the foreign market, they should certainly be well qualified to hold such an exhibition.

The Eastern Extension, Australasia and China Telegraph company is an English corporation. It owns the submarine cable line between Hongkong and Manila, which was cut by Admiral Dewey after the naval battle in which the Spanish fleet was destroyed and the fortifications of the bay reduced. The last report of the directors of the company for the half year ended December 31st, which has just been given out, mentions the fact that direct cable communication with Manila had been established. The report says: "The contract made with the Spanish government for extending the company's system from Manila to the islands of Panay, Negros and Cebu was successfully completed and the new cables opened for traffic in November last. Since the close of the half year a further contract has been entered into with the Spanish government for improving telegraphic communication with the Philippines by extending the Hongkong cable, which was originally landed at Cape Bolinao (Luzon), direct to Manila. The contract was completed last month, and the station at Bolinao removed to Manila." Since the work just mentioned was completed the comparatively insignificant cable line to Manila assumed considerable importance. It was not thought when the extension was undertaken that the Manila cable was destined to become such an important factor in the affairs of Europe and America.

Several important points of law affecting the rights and obligations of electrical construction and central-station companies were elucidated by the Court of Appeals of Texas recently in passing upon the case of the A. J. Anderson company against the Cleburn Water, Ice and Lighting company. Action had been instituted to recover the contract price of an electric-light plant, alleged to have been erected in compliance with a written contract. The case had been once before considered by the Court of Civil Appeals and sent back to the trial court for rehearing. In the opinion accompanying the second review of the case the court declares that if a construction company fail to construct a plant in substantial compliance with the terms of the contract, and the central-station company refuse to accept it in an incomplete state, and by reason of the former's default the latter be damaged, the latter can recover as damages the difference between the value of the plant, if completed in accordance with the terms of the contract, and the price agreed to be paid by the contract. If there had been a delivery and an acceptance of the plant in an incomplete condition, then, the court holds, the measure of damages of the company that ordered the plant would be the difference in the value of the plant actually constructed and the value of the plant if constructed in accordance with the terms of the contract. Again, if the construction company fail to furnish and wire certain lamps in accordance with the terms of the contract, and the other company accept the plant in such incomplete condition, the court holds that the latter company is entitled to have considered as a proper basis for damages that it was to have received the sum paid by the persons having the use of such lamps, or the sum of $2.50 per light, and that it is not necessary to set out the names of all the persons from each of whom that sum would have been received if the lamps had been wired in. The court further declares that when a contract provides that the acceptance of an electric light plant shall be subject to the approval of a certain named electrician, and when the company constructing the plant makes an effort in good faith to get that electrician to examine it, that provision of the contract will be substantially complied with; but that where the company does not in good faith make an effort to secure such examination of the plant by the electrician specified, and it is not examined by him, that will constitute a complete defense to a suit by the construction company on the contract.

WAR NEWS.

Battleship Detecting Approach of Torpedo Boat by Searchlight.—Nearly every American of average intelligence must have gained at least a superficial knowledge of the methods of modern naval warfare by the quickening influence of the present war. It will be sufficient, therefore, to merely indicate the value of the searchlight in the defense of large warships from torpedo-boat attack at night, to appreciate Mr. Lee's fine drawing, which is herewith reproduced from Collier's Weekly. When it is considered that a battleship may be attacked by several 25 or 28-knot torpedo boats at once; that the boats may come from several points of the compass at the same instant; that any one of them, by getting within torpedo range of the object of attack, may launch a missle of destruction that will literally blow the ship out of water, and that all this is done "Under Cover of Night," as Mr. Lee entitles his picture—the paramount importance of the fierce, searching beams of the electric projectors of the great ship is at once apparent. But once the on-rushing boat is "picked up" by the searchlight it is doomed. It will be almost inevitably riddled and sunk by the storm of steel projectiles from the battleship; and the projector will have demonstrated its useiulness.

Cable Cutting at Cienfuegos.—On May 11th the cruisers Nashville and Marblehead, which have been doing blockade duty on the southern coast of Cuba, were ordered to Cienfuegos, with the revenue cutter Windom, to cut the cables there, this being part of the plan to isolate the Spanish forces on the island from the rest of the world. The map published in the Western Electrician of April 16th shows that three cables land at Cienfuegos, all connecting with other ports on the southern coast of Cuba. One goes west to Batabano, another east to Manzanillo, and the third, the most important of all, is a duplicate cable to Santiago, where it connect with the direct cable to Jamaica and also with that to Hayti by way of Guantanamo, thus giving communication with Europe. Two of the cables were cut, but the Americans were forced to retire under a heavy fire from the shore before finishing their task, and the third cable remained intact. It is said that this is the eastern inshore cable leading to Manzanillo. If the land line between Manzanillo and Santiago is open to the Spaniards, General Blanco can still telegraph from Havana to Madrid.

The cable-cutting expedition consisted of volunteers in four boats (two steam launches and two cutters), protected by the guns of the Nashville and Marblehead. The boat party consisted of men with grappling irons and cable-cutting tools, sailors at the oars in the cutters and a guard of marines. The official report states that the men performed their work with the utmost coolness and intrepidity under the fire from the infantry and Maxim guns on shore. The Spanish soldiers were sheltered in rifle pits and masked batteries, but must have sustained considerable loss from the fire of the ships and boats. The American loss was two men killed and seven wounded. Lieut. Winslow was slightly wounded.

Other Cable News.—It has been asserted that the French cable company delayed for 24 hours an important dispatch to Washington from Captain Cotton of the United States auxiliary cruiser Harvard at St. Pierre, Martinique. But the truth of the assertion is denied by the manager of the company in Martinique, who makes this statement: "Captain Cotton presented himself at the office of the company at St. Pierre and asked by what cable line messages were transmitted to Washington. When he was informed that such messages went by way of Fort de France and Hayti he refused to give us his dispatch, because a Spanish torpedo boat was at that moment at Fort de France. Not taking into account professional secrecy, he told the American consul in the presence of M. La Lung, under these circumstances he preferred to give his dispatches to the English company, in spite of the delay of 24 hours which they have to submit to on account of accumulation of business on the lines of that company. I protest against the statements made, as we leave our office open to midnight or one o'clock in the morning when necessary, while the West India company closes at six o'clock in the evening, local time, and also because we do everything possible to be agreeable to the American government, forwarding its messages very rapidly, when we have any." The United States consul partly corroborates the manager's statement.

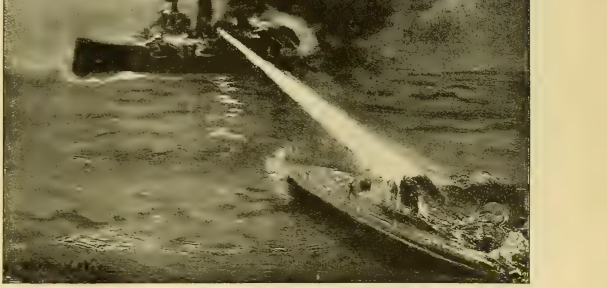
On Sunday it was asserted in New York that the North Atlantic cables were to come under the government censorship, the telegraph companies having received instructions to send by cable no message pertaining to the movements of American men of war which would in any way give the outside world information of contemplated naval operations. But two days later the Anglo-American Telegraph company issued the following notice: "Pending further decision by the chief signal officer, we will accept press messages without restrictions." A still later dispatch states that a censorship has been practically established.

The Mediterranean cable is still interrupted.

The cable between St. Lucia and St. Vincent, in the West Indies, was interrupted for a few days, cutting off telegraphic communication with St. Vincent, Barbadoes, Grenada, Trinidad and British Guiana. This interruption was thought to have been possibly caused by the Spanish fleet off Venezuela, but was probably due to one of the many accidents which befall ocean cables.

Electricians Drowned in New York Bay.—The French liner La Touraine, outward bound, through the main channel off Sandy Hook point, on Saturday last, upset a surl boat containing eight men, who were engaged in laying submarine mines. Two electricians were drowned and two more were severely hurt. The other four were picked up by a patrol tug and landed at Fort Wadsworth. The two who had been injured were taken to Sandy Hook. The government employes and members of the engineer corps blamed the pilot of the French liner.

About the time the steamer left her pier Lieut. Robert McGregor, Corps of Engineers, U. S. A., stationed at Sandy Hook in charge of the mine fields, had sent out three boats' crews from the battalion of engineers to replace two or three groups of observation mines that had been carried away just off the Hook by passing steamships. When the boats were sent out patrol tugs were ordered to warn approaching vessels away from the small boats. A few minutes after 12 one of them, the Atwood, sighted La Touraine coming down the main channel. As soon as the Atwood sighted the liner the tug signaled to the pilot to keep close to the white buoys, because boats were mining the channel just off the Hook. The pilot of the liner said he endeavored to follow the instructions, and thought he had done so, but in navigating the narrow channel he fouled the cable and upset the boat. It seems that the men at work in the small boat had the cable lifted across the bow of the boat. They were attaching a junction box to it when the steamer came along. The tug William McKinley was in the channel, and to avoid her La Touraine sheered to the right, and in sheering fouled the cable and upset the small boat. Of the eight men in her, two clung to the box on which they were at work. They went down and did not reappear, both of them being drowned. The men who were drowned were Victor Pessa, an electrician who lived in Brooklyn, and Robert Middleton, an employe of the General Electric company, who resided in Orange.



BATTLESHIP DETECTING APPROACH OF TORPEDO BOAT BY SEARCHLIGHT.

Wonderful Expansion of Wireless Telegraphy Proposed.—The following communication, appearing in the Pall Mall Gazette of London, was apparently written in good faith: "In these stirring times of war, it has become more patent than ever how important it is for this country to be in uninterrupted telegraphic communication with its numerous colonies and dependencies. The mere possibility of the cables between Cuba and the outer world being cut naturally suggests what is in store for this country should it unfortunately be at war with a first-class power. I am surprised that a proposal made by Prof. Silvanus Thompson, in his recent lecture on 'Telegraphy Across Space' at the Society of Arts, has not created the attention it deserves, coming, as it does, from so high an authority. The proposal was, that if £10,000 were put at his disposal for the purpose, he would be able to erect the necessary apparatus for telegraphing without wires intervening between this country and any part of the globe. To be able to telegraph from London to Cape Town or to Calcutta, or to any where you like, without the possibility of the wires being cut, for the simple reason that under Prof Thompson's plan there would be none to cut, is certainly a consummation devoutly to be wished.' I suggest that Prof. Thompson's plan be further examined, and if he can substantiate his claim—as from his great reputation there should be little doubt—the necessary funds should be put at his disposal by government, in order to enable him to complete his experiments and to bring to perfection his plan of telegraphing across space." Prof. Thompson's remarkable offer is said by the London Electrical Review to have been a "passing remark."

The Signal Service.—Lieut. Samuel Reber, U. S. A., chief signal officer of the Department of the Gulf, has been ordered to report to General Shafter at Tampa, and has left Atlanta for that purpose. Lieutenant Reber has many friends among electrical men, as he has devoted much time to electrical study and experiment. He was one of the judges of the Department of Electricity at the World's Fair.

Captain R. E. Thompson, of the United States Signal Corps, passed through Chicago early in the week on his way to San Francisco, having been detailed to take charge of the government electrical work, in connction with cables and army and navy signaling in the Philippines.

Periodic rumors of the approach of Spanish warships have disturbed some nervous people along the New England coast. However, the signal service is very well established and the actual near approach of a foe seems impossible without ample warning being given.

Miscellaneous Notes.—Manager Naylor, of the electric light plant in Wadena, Minn., has placed red and blue electric lamps on top of the water-tank to give notice of the way battles have gone in the war. If Spain is winner the red lamps will be turned on; if the United States is on top, the blue will announce the glad news.

Throughout Spain there are a number of electric-light enterprises worked by British capital, and in fact having head offices in London, and among these is the Malaga Electricity company. The difficulty of obtaining fuel supplies, owing to coal being contraband, necessitates the closing down of the company's works. This has led to correspondence between the directors and the British Foreign Office as to whether steamers could be chartered from England to carry coal to Spain for purely commercial purposes. The reply from the Foreign Office (which, as the London Electrician says, is very diplomatic) is as follows: "I am directed by the secretary of state for foreign affairs to acknowledge receipt of your letter inquiring whether, in the circumstances stated therein, you may charter two Steamers from this country to convey coal to Bilbao and Malaga. In reply, I am to state to you that his lordship regrets that he cannot offer any advice on such questions. In time of war commercial transactions must be conducted at the expense solely of those interested in them who can obtain, if necessary, such legal advice as it would be open to them to take in other important matters. I am to add that to give official advice in such matters would be a departure from the course which has been pursued by this department in the case of former wars."

W. J. Gray & Co. of Minneapolis will furnish an estimate of cost for putting in an electric-light plant for Madison, Minn.

DEVELOPMENT OF THE TELEPHONE FIELD.

Protecting Telephone Circuits from Heavy Currents.

Lightning is not the only destructive agent against which the telephone manager must constantly guard, as heavy currents for power and lighting service are equally dangerous. The device illustrated in the accompanying cuts is intended to protect telephone switchboards from heavy currents of all kinds and it is designed to automatically cut out the telephone line before a point of danger is reached. It is not necessary to impress upon experienced exchange managers the necessity of adopting some method of protection. Fig. 1 shows the general form of an arrester of 100 lines, with the spring in the center, A A. Fig. 2 is a cross-section of the spring, electromagnet, armature, etc., and Fig. 3 shows the cross-section of Fig. 1.

The practical operation of the device may be explained as follows: The lines come from the cable terminals inside of the office to the cross-connection board, through the two binding-posts, along the automatic spring, over the ground strip, which is insulated from the springs, and through the one-fourth-ampere mica fuses to the switchboard. When a heavy current comes in on any line, it will, of course, seek a ground through the path of

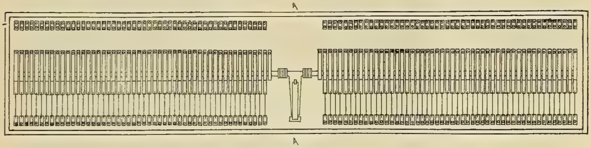


Fig. 1. One-hundred Line Automatic Lightning Arrester.

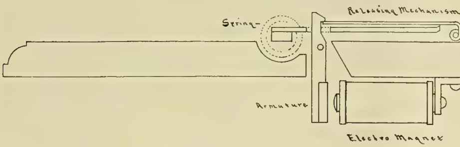


Fig. 2. Cross section at AA.

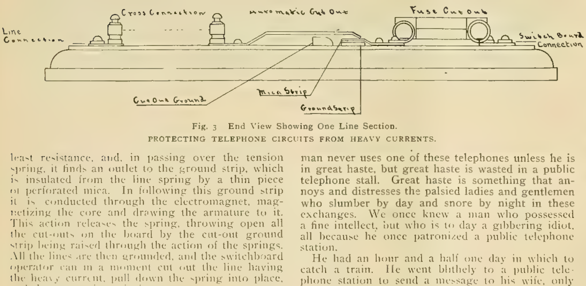


Fig. 3. End View Showing One Line Section.

PROTECTING TELEPHONE CIRCUITS FROM HEAVY CURRENTS.

least resistance, and, in passing over the tension spring, it finds an outlet to the ground strip, which is insulated from the line spring by a thin piece of perforated mica. In following this ground strip it is conducted through the electromagnet, magnetizing the core and drawing the armature to it. This action releases the spring, throwing open all the cut-outs on the board by the cut-out ground strip being raised through the action of the springs. All the lines are then grounded, and the switchboard operator can in a moment cut out the line having the heavy current, pull down the spring into place, and the system is again in service.

If the operator should notice a fluttering of the drops, indicating the presence of a heavy current, the pressure of a button provided on the switchboard will throw a battery current into the electromagnet and open the arrester. With a device of this kind it is claimed to be impossible for heavy currents to burn out switchboard apparatus.

Another excellent feature of the device is its quieting effect on the line, taking off the induction and noises through the proximity of the line to the ground strip. This automatic arrester has been in service for about a year, and its usefulness has been demonstrated on many occasions in saving switchboards from absolute destruction. It is made by the Keystone Telephone company of Pittsburg.

Crossing of Telephone and Trolley Wires.

A serious fire is reported to have taken place in the Zurich telephone exchange, as a result of a telephone wire falling across a trolley line. The accident caused a jet of flame to shoot out of a spring jack as the operator was making a connection. Simultaneously at different parts of the switchboard this experience was repeated, and in an instant the whole wooden board was on fire, and the operators had barely time to escape. One girl received a shock which threw her to the ground. Although the fire was extinguished in two hours, the whole exchange was completely burnt out. Several accidents have recently occurred in Switzerland through telephone wires falling upon traction conductors. In Geneva and in Basle two men were killed from this cause, and near Gersau, on the Vierwaldstätter See, a wood was set on fire by a contact between telephone and trolley wires, and two men who were assisting in extinguishing it received fatal shocks.

Public Telephones in Greater New York.

Anybody who has ever given up 15 cents for the privilege of swearing four or five hours into a public telephone, with an instrument of torture more terrible than the iron boot glued fast to his ear, will be delighted to learn that the telephone companies have concluded to raise the tariff on this sweet privilege to 25 cents a throw, says the New York Telegram. There is probably nothing on earth so grateful and comforting as sending a message through a public telephone station in Greater New York. A man never uses one of these telephones unless he is in great haste, but great haste is wasted in a public telephone stall. Great haste is something that annoys and distresses the palsied ladies and gentlemen who slumber by day and snore by night in these exchanges. We once knew a man who possessed a fine intellect, but who is to day a gibbering idiot, all because he once patronized a public telephone station.

He had an hour and a half one day in which to catch a train. He went blithely to a public telephone station to send a message to his wife, only five blocks away. He gave the password to the attendant, and shut himself up in the stall. He placed the receiver to his ear and waited. Then he waited some more. Then he rang the bell and said "please." Then he rang the bell again and courteously inquired what in the name of Gen. Blanco and his band of black-hearted pirates was the matter. A courteous voice answered and said: "I—sss -33 w—!! !!333—boom rah!!"

This information, while valuable, didn't satisfy the gentleman, so he took hold of the bell handle and twirled it until his arms ached and his eyes bulged out and his tongue cleaved to the roof of the house. Then he yelled into the machine again and asked a question that we cannot find room for in this column. Just at that instant somebody blew up the battleship Maine and a train of cars ran off a high trestle, and by some happy chance the noise of the double catastrophe was instantly transmitted to the patient gentleman's ear. The shock so pleased and delighted him that he tore the receiver out by the roots and kicked a hole through the side of the building and knocked out a side of the boxstall and set the house on fire with red, white and green cuss words. When he finally reached the street and ran shrieking to the station he found his train had been gone a couple of hours, and then he fell in a fit and was carried away to a padded cell. By all means let the telephone rates be raised—let them be raised high enough to prevent such awful tragedies as this.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Iowa and Nebraska Telephone company, with headquarters at Spirit Lake, Ia., has bought the Cherokee, Ia., Telephone company, which owns exchanges at Spirit Lake, Sibley, Sheldon and Wayne, Neb.

The local telephone exchange for New Richmond, Wis., is to be put in at once. A. T. Presson of Hudson is the owner.

The ordinance and resolution committee of the Duluth, Minn., council reported against regulating telephone rates, in view of the opinion of the city attorney. It sets forth that rates should be as low as named in the proposed ordinance, and recommends that the city should either get such rates on granting a new franchise or should construct a system of its own.

The Watertown Telephone company of Watertown, S. D., has put in new receivers and transmitters, which have greatly improved the service.

The Atlantic-Corning Telephone company has completed a line between Atlantic and Corning, Ia. The wire will probably be leased to the Mutual Telephone company, which is now endeavoring to secure a franchise in Atlantic.

F. L. Cliff of Ortonville, Minn., has been granted a franchise for a local exchange at Wheaton, Minn. It will connect with the Minnesota Central Telephone company's wires.

The Northwestern Telephone Exchange company, whose men were arrested in Minneapolis, while setting poles on Lake street, holds that Lake street is a post road. Furthermore, it had a large crew of men idle, waiting for permission to set the poles, which had been promised but failed to come, and finally took matters into its own hands to force a decision.

The Western Electric Telephone company will extend its toll wires to Howard, S. D., and probably to Canova, S. D.

The Minnesota Mutual Telephone and Telegraph company is soliciting subscriptions to build a line along the St. Paul and Duluth railway from Rush City, Minn., to St. Paul.

The Northwestern Telephone Exchange company is securing a right-of-way into Madison, S. D., by condemnation proceedings. This company has begun proceedings for a right-of-way between Hutchinson, Minn., and Glencoe. The same company has also begun work on a toll line from Anoka to Cambridge, Minn., via St. Francis.

The Nicollet County Telephone and Telegraph company of New Sweden, Minn., has been incorporated to build a telephone line from Winthrop, Minn., to St. Peter.

The Perry Telephone company has material ordered for the new exchange to be put in at Adel, Ia. The Iowa Telephone company has now made application for a 20-year franchise at Adel and offers to bear all expenses involved in granting the franchise.

The Jefferson Telephone company has moved its exchange to new quarters in Jefferson, Ia.

The Union Telephone company has put in a new 100-drop switchboard at Boscobel, Wis.

The Cedar Valley Telephone company has completed connection with Finchford, Winslow and Boies, Ia.

The Iowa Telephone company has been soliciting subscribers at Elkader, Ia., for an exchange.

The Pierce County Telephone company of Ellsworth, Wis., and the Hudson Electric Exchange company of Hudson, Wis., are arranging to extend toll lines to the Twin Cities. This will give connection with a great many of the smaller towns near the western boundary of Wisconsin.

The Mississippi Valley Telephone company has begun work in Minneapolis, in order to protect its bond, by dressing poles and supplying them with crossbars. The company expects to have its system in working order by January 1st.

The Wisconsin Telephone company is pushing work on its toll lines in northwestern Wisconsin and expects to have connection between Ashland and Stevens Point, Eau Claire and other points by July 1st.

A telephone line will be built to connect Galesburg, Hillsboro, Blanchard and Clifford, Wis.

The Dakota Central Telephone company of Aberdeen, S. D., has connection with 52 towns now and expects to be connected with 100 towns by July 1st.

The annual meeting of the La Crosse Telephone company was held in La Crosse, Wis. The company has 631 subscribers, a net gain of 113 in the past year.

The Marshfield telephone exchange will be established at Marshfield, Wis., at once.

The Northeastern Telephone company has been incorporated at Rush City, Minn., with $50,000 capital stock. Connection will be made with the Twin Cities, via Stillwater.

The Rocky Mountain Bell Telephone company

will construct a line from Missoula, Mont., to Wallace, Idaho, as soon as the weather will permit.

The Spokane and British Columbia Telephone company has completed long-distance connection with Republic.

Automatic Telephony in England.

Promoters of the automatic telephone system, which has been developed in this country during the last few years, have succeeded in attracting English capitalists and forming the Direct Telephone Exchange Syndicate of London. The English corporation is introducing two distinct systems, one for exchanges of less than 400 subscribers and one for those having a greater number of instruments connected. It is explained that there must be one automatic switch for each subscriber in any case, and in exchanges to which not more than 400 subscribers are connected their lines are "multipled" to each subscriber's switch. In larger automatic exchanges there are two automatic switches per subscriber, one being a junction-wire switch, for it would not be feasible to multiple every subscriber's line at each switch.

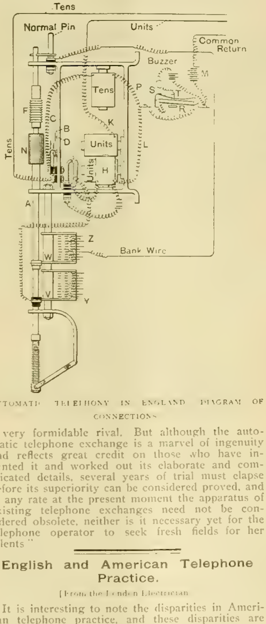
In a 100-subscriber system the numbers are from 101 to 199. Two lines are necessary for each subscriber to the exchange, and in addition either an earth return or, preferably, a return wire common to all the subscribers. The two lines are called for distinction the units line and tens line. The first movement of the disk on the subscribers' instrument connects the units line once to the common return, the second movement sends a number of similar current impulses through the tens line, and the third movement sends currents to the units line again. The first current flows from the battery M in the exchange (see cut), through the wire L, and the electromagnet marked "Units," to the units line by way of the wire K. At the subscriber's instrument it passes to the common return, and comes back through the latter to the battery M. The units electromagnet causes the toothed cylinder N, which is fixed to the shaft A, to rotate one tooth; it then throws two pawls into engagement with A to prevent it from turning further until the armature is again attracted, and finally it moves the spring B over to C and away from the contact D, which is connected to the frame of the instrument. The currents through the tens line start from the battery M, pass through P and the electromagnet marked "Tens" to C, thence to B through the tens line to the subscriber's instrument, and back to the battery through the common return. The armature of the tens electromagnet acts on the rack F and lifts the shaft A bodily by a number of teeth on F corresponding to the number of current impulses sent (that is to the number of tens in the figure required). The third series of impulses, through the units magnet, turns N through a number of teeth corresponding to the number of units. The shaft A carries a "wiper," W, of copper strip, this moving over a number of rows of contacts arranged in an insulating segment Z of impregnated plaster of paris. There are 10 rows, and 10 columns of these contacts, one for every subscriber to the exchange. The first current-impulse on the unit line brings the wiper in position one tooth behind the first contact, the impulses along the tens line cause it to find the row corresponding to the tens required, and the next series of currents along the unit line rotate the wiper until it reaches the contact required. This leaves the tens and units wire of the calling subscriber connected to the subscriber wanted, and the former rings up. After the conversation is concluded, the action of hanging the receiver on the switch hook sends two successive currents to line, the first through the units, and the second through the tens line, and things are restored to their normal condition.

It has been found necessary to devise means for preventing subscribers cutting in on lines in use. Every subscriber's line is connected to the switches of the other subscribers through an insulated pin, marked "normal pin" in the cut, connection only being made to this when the shaft A is in its normal position. This effectually prevents the line of the subscriber who has called originally from being reached by any other subscriber until the former has finished his conversation. But to protect the called subscriber during the conversation is not such a simple matter. It is necessary to multiple all the subscribers again at each switch on a segment Y, in an exactly similar manner as on Z, but in this case connection is made by an insulated wiper, V. A system of switch contacts is arranged in connection with the wipers V and the electromagnet H, so that if a second connection is made, at another switch, to a line already connected, the electromagnet H of the second calling subscriber is energized and actuates a spring switch which opens his own circuit.

The current used to actuate the electromagnets in a 100-subscriber exchange is about half an ampere. The contact disk of the subscriber's instrument sends nine current-impulses per second. The resistance of the units coil is 16 ohms, and this coil is in circuit during speaking. In the case of larger exchanges this cannot be permitted, a coil of higher resistance and self-induction must be used. A bridging retardation coil, with a connection to the middle point, is then employed.

In exchanges fitted for over 100 subscribers, in addition to switches similar to those already described, there is added for each subscriber what may be called a junction-wire switch. Taking a 1,000-subscriber exchange, for instance, the subscribers are arranged in groups of 10. Each subscriber has his own junction switch, and there are also 10 of the previous type of switches for every group of 10 subscribers, the latter switches being placed below the junction switches. The first of the three sets of current-impulses, sent by a calling subscriber, actuates the junction switch, and connects his line to the one of the 10 junction lines corresponding to hundreds. Each of these lines is connected to one of the lower row of switches, and the currents corresponding to the tens and units demanded actuate this second switch, and so connect the subscriber through to the one he desires connection with. The arrangements to prevent connection to an engaged line or engaged junction line are similar to, but necessarily somewhat more complicated than those used in the smaller exchanges.

It will be noticed that several important modifications have been made since this system was introduced into this country. The English telephone men, it appears, are not satisfied with the record of the system thus far. The London Electrician, for instance, discusses the question of comparative first cost and says: "The makers claim that the actual cost of a board for 5,000 subscribers is less than that of a manual board of equal capacity. If this claim is substantiated in practice, if the repairs and maintenance account is below the amount now paid to the operators in wages, if the apparatus can be maintained in repair without interruption to the continuity of connections, and if the net gain in cost is sufficient to cover the increased price of the subscribers' instruments, then the manual board has



AUTOMATIC TELEPHONY IN ENGLAND—DIAGRAM OF CONNECTIONS.

a very formidable rival. But although the automatic telephone exchange is a marvel of ingenuity and reflects great credit on those who have invented it and worked out its elaborate and complicated details, several years of trial must elapse before its superiority can be considered proved, and at any rate at the present moment the apparatus of existing telephone exchanges need not be considered obsolete, neither is it necessary yet for the telephone operator to seek fresh fields for her talents."

English and American Telephone Practice.

[From the London Electrician.]

It is interesting to note the disparities in American telephone practice, and these disparities are well brought out by the descriptions, in another part of this issue, of three American exchanges. As a fourth, a new 4,000-subscriber exchange just completed by the Bell company in St. Louis, might have been described. The last combines nearly all the most modern improvements in exchange equipment. The underground system in St. Louis has already been described, and to this is added a system of automatic calling and ringing off by the action of the subscriber removing and replacing his receiver on the switch hook, a method somewhat similar to that originally introduced by the British postoffice. The latest improvements in common working have been adopted, including the successful training of the subscriber to understand the meaning of a "busy back" note, a signal far more and no less irritating than the verbal reply of "engaged," but saving one action in operating. Finally, the chief operator's board is provided with indicating lamps, one connected to the indicator at each operator's position, so that a check is had on the promptness of replying to calling and clearing signals. The last improvement is also in use in some continental exchanges, and it might with advantage be introduced into this country.

The new John street exchange in New York offers a strange contrast to this. A clumsy system of transfer working is employed instead of multiple switching, although the exchange is equipped for no fewer than 1,200 subscribers. What may be the reason for this is difficult to see, unless it is a disinclination to pay royalty for the use of multiple working, this being, we believe, still protected by patents in America. That nearly every local connection in a 1,200-subscriber exchange should have to be dealt with by two operators is distinctly a retrograde step. The small exchange in La Crosse also uses a novel system of transfer working, but in a small exchange, where the question of a cheap rental is the foremost one, this is more excusable. In commenting on American methods it may also be mentioned that the breastplate transmitter appears to be very little used in that country, in spite of its obvious convenience. It can adjusted closer to the operator's mouth than the suspended transmitter—which is even employed in the new St. Louis exchange—and it materially lessens the noise in the switch room. We also notice that the number of operators employed appears to be relatively less than in this country. In La Crosse one operator attends to the demands of 100 subscribers; in the John street exchange there are 16 operators' positions for 1,200 subscribers, and in St. Louis the three operators of each section attend to 260 subscribers. In the "Avenue" and "Bank" exchanges in London the number of subscribers per operator's position is 50, the mean for all the metropolitan exchanges being 52.5; in Leeds and Liverpool one operator attends to 66 subscribers during the busier hours of the day, and in Manchester, where the call-wire system is used, the figure is again 50. Are the American operators smarter than the English ones, or is it that the subscribers are more patient?

Right to Use Streets for Telephone Purposes.

One of the most important legal questions confronting those who wish to establish or extend telephone systems is whether the erection of poles and stringing wires thereon, in a street, is within the contemplated use of the street, or is an additional burden upon the title of the abutting proprietor, who owns to the center of the street, subject to the rights of the public to use the street for recognized street purposes, requiring compensation to or consent from him.

This was the principal question in the case of Magee against Overshiner, which was a suit brought to compel, by a mandatory injunction, the removal of a telephone pole placed in the curb-line of the sidewalk in front of Magee's property, fronting upon one of the principal streets of the city of Logansport, Ind. The pole had been placed and the wires strung during the night, after a protest. From a judgment in favor of the owner of the telephone system, who was made the defendant, an appeal was taken to the Supreme Court of Indiana, which affirmed that judgment, March 29, 1898.

In the accompanying opinion the Supreme Court says that the decisions of the courts of this country, so far from establishing a definite rule upon the question involved, are at such variance as to render hopeless any effort to reconcile them. And text writers justly renowned, it adds, have grouped many of the cases, which it cites, and have variously expressed the opinion that the weight of authority forbids the use of an urban way for telephone equipment. But the court declares that it has found no analysis of the cases, and no attempt by such writers to classify the cases applying to urban and suburban ways, and no effort made by them to consider the reasons supporting the cases which uphold the use as within the scope of proper street uses.

Because a street was dedicated or condemned before electric inventions for lighting, communicating oral and telegraphic messages, and propelling street cars were thought of, the Supreme Court does not believe that it will suffice to say that it could not therefore have been condemned or dedicated in contemplation of the uses therein of such inventions. It must be, however, that the contemplated uses should be deemed to have been, not only in the walking, riding upon horseback and in wagons or other vehicles drawn by animals, in the going and returning upon business, social, religious or political missions, but also by such methods of travel and communication, in addition or in substitution for those that might come into vogue and be accepted and recognized as proper and important uses of the street in the varying needs and demands of commerce, and the relations of man to man socially and otherwise. That a dedication or condemnation is deemed to comprehend uses not actually in the minds of the parties at the time is seen from the almost unvarying rule that the electric street-railway systems are not a new use and an additional servitude, but are a new method of enjoying an old and ever existing use.

Furthermore the Supreme Court declares that it observes no means of distinguishing against the telephone equipment, on the ground that its poles are not in motion as are ordinary instruments of travel, since the permanent occupancy by the trolley poles, the gas and water pipes, etc., is maintained. On the

other hand, it pronounces the telephone more clearly a substitute for the old methods of the communication of messages between persons within the city than the telegraph, laying some emphasis on the fact that the former can be used for that purpose directly, and by persons without special skill.

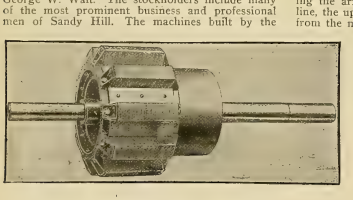
Consequently, the Supreme Court of Indiana concludes that the reasonable use of the streets of a city for the equipment of a telephone system is not a new and additional servitude, for which the abutting property owner is entitled to compensation. Nor does it agree that the ordinary pole and wires are a special injury to the enjoyment of the abutting property.

Last of all, the Supreme Court holds that it is no reason why a telephone system may not be owned and conducted by an individual, merely because the Legislature has granted such rights to corporations, inasmuch as an individual may conduct any proper business without legislative assent, unless there has been some legislative restrictions upon such right.

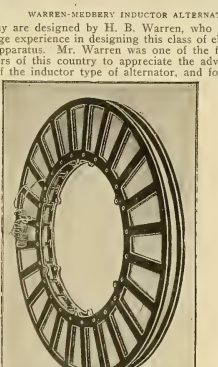
Warren-Medbery Inductor Alternator.

A late and interesting alternator of the inductor type is that built by the Warren-Medbery company of Sandy Hill, N. Y., details of which, from a 150-kilowatt machine recently installed in the station of the Ballson Electric Light company of Ballston Spa, N. Y., are illustrated herewith.

The officers of the Warren-Medbery company are: President and general manager, H. J. Medbery; vice-president and electrical engineer, H. B. Warren; secretary, H. E. Edmarsh; treasurer, George W. Wait. The stockholders include many of the most prominent business and professional men of Sandy Hill. The machines built by the company are designed by H. B. Warren, who has had large experience in designing this class of electrical apparatus. Mr. Warren was one of the first engineers of this country to appreciate the advantages of the inductor type of alternator, and for a number of years he has devoted particular attention to this branch of engineering. The result is a machine combining, in the highest degree, all the desirable features of modern alternators.



WARREN-MEDBERY INDUCTOR ALTERNATOR.



WARREN MEDBERY INDUCTOR ALTERNATOR.

The inductor alternator is deservedly a popular and satisfactory type of machine from the operator's point of view, as is shown by the fact that in so many of the increases and additions to existing central-station plants inductor machines are specified. This is very significant, as it demonstrates that experienced operators of electrical apparatus have become convinced that the remedy for many of the trials of the station manager lies in the use of this type of generator.

Another important consideration for any class of work is the insulation of the armature coils. This can be best obtained in stationary armatures, because in such there is practically unlimited space available for insulation, and the coils are not subjected to the mechanical strains accompanying revolving armatures. In inductor armatures the coils are carried on a rigid structure, and may be insulated to any required degree; 10,000 volts is a practical working pressure. The economic value of this feature of power transmission is that the generator, operating at the pressure required on the transmission lines, calls for no investment in step-up transformers and cuts out the constant loss of power which occurs in such devices.

The accompanying illustrations of parts of the standard single-phase belt-driven generator show clearly the characteristics of these machines. The lower half of the frame, with the base and supports for bearings, constitutes a single casting, insuring great strength and rigidity in the machine, guaranteeing the accurate centering of the revolving inductor while assembling the machine and maintaining perfect alignment while in operation. The bearing sleeves are lined with a high grade of anti-friction metal; the bearing surfaces are unusually large and the peripheral speed of the shaft in the bearings is moderate. The bearings are self-oiling from an oil reservoir of large capacity, and the distribution of oil throughout the bearings is remarkably abundant, being effected by a peculiar arrangement of oil ducts in the interior of the bearing sleeves. The bearing sleeves are made solid, as being the most convenient form for babbitting, in case it should become necessary to re-line the bearings. The supports for the bearings are so designed that when it is desired to remove a bearing sleeve the only operation necessary is the removal of the bearing cap, after which the sleeve may be slipped endwise off the shaft. The sub-base carries polished steel skids and the machine rests upon these skids with an interposed layer of babbitt, accurately shaped to the configurations of the skids. By means of a powerful ratchet and adjusting screw the belt tension may be easily and quickly regulated.

By the removal of the two frame bolts and opening the armature circuit on the horizontal central line, the upper half of the frame may be lifted away from the machine. The upper half of the machine carries the upper half of the armature and the corresponding armature coils. The revolving inductor is surrounded at its smaller end by the field coil, which is attached to an annular yoke casting. After the upper half of frame and armature are removed, the revolving inductor, field coil and yoke may be lifted out. By this method of construction all of the coils of the machine are readily accessible for inspection and repairs.

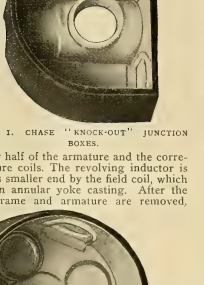


FIG. 1. CHASE "KNOCK-OUT" JUNCTION BOXES.

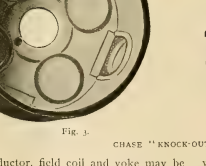


Fig. 3.

CHASE "KNOCK-OUT" JUNCTION BOXES.

The armature body is built up of a special grade of soft steel, and the method of handling the metal prevents any injury to its structure which would increase the losses due to magnetization. For the armature metal of a very thin gauge is used, and the sheets are served on both sides with an insulating compound which is not affected by heat or age. By this means, the armature eddy currents are thoroughly broken up, and no loss of power occurs from heating. In addition to this, there is a series of recesses between the cast frame and the outer circumference of the armature. These recesses are entirely internal, and the exterior of the frame casting is retained smooth and symmetrical without unsightly openings for ventilation purposes. The machines operate remarkably cool, as no point rises over 50 degrees Fahrenheit, even when operated continuously under 10 per cent. overload.

The armature coils are machine wound and of a plain oblong type, with easy corner bends. This simple form of coil reduces to a minimum the hazards of winding, for neither the structure of the wire nor its covering are subjected to the strains attendant upon the winding of complicated shapes with sharp bends, or of coils which are forced into place in the armature. These coils are thoroughly saturated with an insulating compound which has no affinity for the copper, but preserves the covering of the wire. For retaining the shape of the coil a single layer of untreated tape is wrapped all around, and over this a thick coat of waterproofing compound is applied, which makes it practically impossible for moisture or oil to penetrate the insulation of the coil. Through all the processes of handling and treatment of coils, great care is exercised to prevent injury to the wire and its covering, and no compounds are applied which will deteriorate with age, or in any way attack the wire or covering. This is accomplished, too, without swaddling the coils in a thick or bulky envelope, which would interfere with a ready radiation of heat from the interior of the coil. The insulation of coils is mainly obtained from a special insulating trough, which forms the interior lining of the coil slots in the armature. These troughs are semi-flexible, practically non-combustible, will not absorb moisture, are not affected by oil, and will not deteriorate with age. The troughs for 1,000 volts and the troughs for 2,000-volt armatures are subjected to a breakdown test of 6,000 volts, and the troughs for high-voltage armatures are subjected to a minimum of 15,000 volts breakdown test.

After the troughs and coils are in place in the armature, an insulating perforated cover closes up the coil slot and secures the coils and troughs in position. The slot cover is perforated, which allows the revolving inductor to drive a continuous current of air around the coils. This produces such a cooling effect that these machines may be operated continuously, under heavy overloads, without serious heating of coils.

The field coil of the machine is of quite novel construction, for in effect, it is simply a coil of wire suspended in air; that is, it has the insulation, the radiating surface and the free circulation of air around it, as if it were merely a coil of wire suspended in space, in contact only with a number of insulating supports. The field-coil case consists of two ring castings, spaced apart with rods of insulating material, and the sides lined at numerous places with narrow strips of narrow material. There is no floor in the case, and the sides are cut away, except where backing is required for the insulating strips. The wire is wound over the insulating rods and is in contact only with the rods and strips; it is a skeleton case, which leaves exposed the outer and inner circumferences of the coil, and practically both sides. The rotation of the inductor produces an agitation of air all round the field coil with a constant circulation outward through the openings in the yoke, and the coil will stand severe overloads without injury.

The machines are handsome in design, of fine finish and incorporate the highest grade of workmanship. The efficiency is remarkably high, being equal in this respect to the best designs of direct-current generators, and the inherent regulation is said to be by far the best yet obtained in alternators of any type. The placing of all the armature coils in a single wreath at one end of the machine, and the surrounding of every armature pole with an armature coil, is thought to produce a better combined efficiency and regulation and a more correct form of current wave than any other construction. To these features the Warren-Medbery company has united a robust and workmanlike construction, comprehending simplicity, accuracy and durability, forming a conjunction of desirable features and producing a practical and reliable machine.

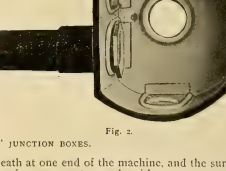


Fig. 2.

Chase "Knock-out" Junction Boxes.

L. A. Chase & Co. of Boston ask attention for their new "knock-out" outlet and junction boxes for inside wiring. This box is made of special grade of iron and heavily coated with a hard, black enamel, having the best insulating qualities. It is so constructed as to have, at frequent intervals on its surface, thin webs or films which a slight blow of a hammer will "knock out," leaving round holes for outlets in as many combinations as are generally required.

The method of attaching the box to the conduit is new and has many advantages. A hollow bushing or nipple, which is threaded on the exterior and smooth and insulated with enamel on the interior, is passed through the hole made in the box at the point desired, and screwed into the coupling on the end of the conduit. This makes a perfect

mechanical connection, which can be made watertight. By means of this nipple wires can be readily pulled through the tube into the box without any danger of abrasion or injury to the insulation of the wires. The Chase box can be instantly disconnected from the conduit by unscrewing the nipples from the inside of the box, thus allowing the box to be withdrawn, regardless of the number of conduits that enter it.

Fig. 1 represents the ceiling outlet box, which may be used for the outlets where the conduits enter from the side or the back of the box. The hole in the center of the box allows for a support for the fixture, or, if used in combination work, the gas-pipe nipple to come through. However, in com-

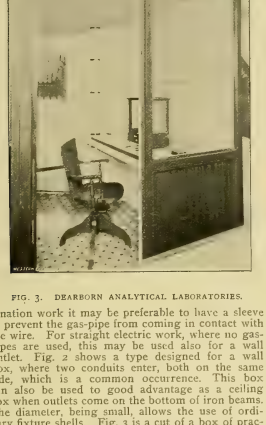


FIG. 3. DEARBORN ANALYTICAL LABORATORIES.

bination work it may be preferable to have a sleeve to prevent the gas-pipe from coming in contact with the wire. For straight electric work, where no gas-pipes are used, this may be used also for a wall outlet. Fig. 2 shows a type designed for a wall box, where two conduits enter, both on the same side, which is a common occurrence. This box can also be used to good advantage as a ceiling box when outlets come on the bottom of iron beams. The diameter, being small, allows the use of ordinary fixture shells. Fig. 3 is a cut of a box of practically the same style as No. 2, with the exception that it has a recess in the bottom, so that it will straddle the tee of the gas-pipe at the outlet. This is a desirable feature in places where the plaster comes close.

Dearborn Analytical Laboratories.

The four small pictures presented herewith show views of the offices and laboratories of the Dearborn Drug and Chemical Works of Chicago. Fig. 1 gives a view of the main laboratory; Fig. 2 shows the private laboratory; Fig. 3 represents a corner of the balance room and Fig. 4 is a picture of the general office.

Since the inception of this institution, some nine

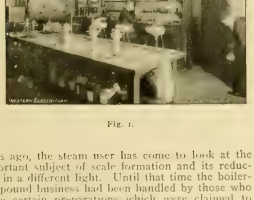


FIG. 1.

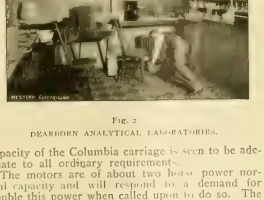


FIG. 2
DEARBORN ANALYTICAL LABORATORIES.

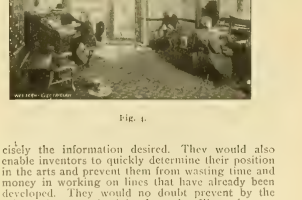


FIG. 4.

years ago, the steam user has come to look at the important subject of scale formation and its reduction in a different light. Until that time the boiler-compound business had been handled by those who made certain preparations which were claimed to meet all the different troubles caused from the thousands of feed-waters throughout the country. The Dearborn people have had a hard fight to convince a skeptical and unbelieving public that this question could be practically and economically solved; but this institution, with W. H. Edgar at its head, realizing the vast expense that scale formation and other troubles from feed-waters was to the steam user, has scientifically and honestly built up what is to-day one of Chicago's most successful and healthy enterprises. All analytical work, such as analyses of waters, scale, oils, etc., and a report and consultation on the analyses, are given freely to the steam user, and, from the busy appearance of the company's well-equipped laboratories, it may be judged that it is becoming thoroughly appreciated by the great power-producing public.

Columbia Electric Carriage.

Horseless carriages are gradually enlisting the favorable consideration of Americans. We are as yet far behind Europeans in the adoption of vehicles of the kind for the practical purposes of business or pleasure, although it is conceded that in point of manufacture we are well ahead of makers on the other side. An automobile club has been formed at Buffalo, which has miles of asphalted streets and fine suburban driveways splendidly adapted to this form of pleasure riding, and a similar club is soon to be organized at Newport, where, last season, a number of Columbia motor carriages, built by the Pope Manufacturing company of Hartford, were in daily use and served to thoroughly stir the summer colonists to an appreciation of the enjoyment of riding in these splendidly appointed, silent and smoothly running vehicles. The Columbia carriage is already engaging the attention of many of the wealthy residents of other cities, in several of which automobiles in actual use are no longer a strange sight. The exhibit of the Pope Manufacturing company at the electrical exposition, now in progress at the Madison Square Garden, New York, is one of the most prominent and interesting features of the entire exhibition, and one which creates a great deal of favorable comment from both the technical and lay points of view.

As may be noted from the accompanying cut, the Columbia carriage resembles a Stanhope phaeton in general appearance, and the general furnishings and upholstering are of the most expensive and durable character. The Pope people began experimenting in the line of developing a satisfactory automobile about three years ago, and shortly afterward alloted a fully equipped factory to the new industry and formally organized a motor-carriage department. The company is convinced that the Columbia electric carriage, with its almost noiseless action and perfect ease of control, comes very near to being the ideal automobile. It is the embodiment of several years of development of the best mechanical and electrical equipment that could be devised.

The motive power is derived from storage batteries which combine great efficiency with the least weight consistent with reasonable life. The batteries can be charged from any direct 110-volt current circuit, such as are commonly used for lighting. Little attention to the charging process is required after the batteries are connected with the circuit, as the current is automatically cut out when the process is complete. A meter at all times shows to what extent the batteries are exhausted, so there is no danger of running out of power away from a source of supply. The cost of charging should not exceed 50 cents if the current is taken from an ordinary city circuit. The batteries are adequate to drive the carriage about 30 miles on good, level roads without recharging. With a view to ascertaining the mileage requirements of persons who "drive all the time"—doctors, expressmen and other constant users of vehicles—the company entered into a searching investigation of the subject. About 18 miles a day was found to be the average mileage of these continuous drivers. So that the mileage capacity of the Columbia carriage is seen to be adequate to all ordinary requirements.

The motors are of about two horse power normal capacity and will respond to a demand for double this power when called upon to do so. The carriages are designed for a maximum speed of upwards of 12 miles an hour on good roads, although speeds are provided for of six and three miles per hour. The same speeds can be obtained backward through a simple reversing process. The steering apparatus is extremely simple, and is manipulated with the greatest ease.

The carriage may be "hitched" when left standing in the street or elsewhere by removing the emergency plug, which is not too large to readily slip into a vest pocket. Until the plug is replaced the carriage cannot be again moved by its own power. A powerful foot brake, operated by very light muscular effort, will "hold" the carriage on any grade, or quickly bring it to a standstill whenever desirable.

Special material, manufactured and tested for this particular purpose, is used in the frame, body, top, upholstering, etc. The wheels are designed to overcome all objections to other existing types, as noted by the company's experts after a long period of careful observation and study. They are Hartford single-tube tires, especially constructed with the object of securing the greatest possible durability, and which are practicably non-puncturable. The performance of these tires has been entirely satisfactory. All parts of the running gear that might be injured by exposure to mud or dust are securely enclosed. Each detail of construction has been worked out to provide the greatest strength with the smallest possible sacrifice of lightness and elegance.

Patents and Inventions.

[Special correspondence of the Western Electrician.]

Washington, May 16.—The commissioner of patents has taken up the subject of securing a concise

COLUMBIA ELECTRIC CARRIAGE.

record of the work of the Patent Office, and, with this in view, has recommended an appropriation for the purpose of completing the "abridgment" commenced several years ago.

The British Patent Office publishes in book form abridgments of patents relating to the several classes of invention. These are of very great value, not only to examiners in the United States Patent Office and to inventors, but to the general public. They afford a ready means of gaining full and accurate information concerning patents granted in England in all classes of invention, and enable manufacturers and artisans to readily determine what inventions have become public property through expiration of patents covering them and what are protected by patents still in force and therefore not to be manufactured or used, except with the consent of the owners of the patents, without risk of suit for infringement.

Nearly every United States commissioner of patents for the last 40 years has recognized the necessity for the publication of like abridgments of United States patents. It has been repeatedly pointed out that such abridgments would be of the greatest value to inventors and to the public. Hundreds of thousands of inventions, many of them of great value, have, by expiration of the patents granted on them, become free to the public to make and use; but those who might engage in the manufacture of such inventions are often unaware of their rights in relation to them. Such abridgments would furnish in compact and convenient form precisely the information desired. They would also enable inventors to quickly determine their position in the arts and prevent them from wasting time and money in working on lines that have already been developed. They would no doubt prevent by the information contained in them the filing of many useless applications and would ensure the filing of applications generally in better shape than at present. The work of making these abridgments was begun in 1881, but was discontinued for lack of the necessary appropriations and has never since been taken up. Abridgments could have been made covering patents granted prior to that year, at that time, at comparatively small expense, and they could have been brought up to date each year since

then for a small annual appropriation. With the great mass of material which has now accumulated the expense would be considerable, but could be met, as can all other needs of the office, without exceeding the annual receipts. A full set of such abridgments would be practically indispensable to attorneys practicing before the Patent Office. There are more than eighteen hundred of these upon the register. Abridgments relating to particular arts would undoubtedly be largely called for by inventors and manufacturers throughout the country.

A full report of the conference of the Union for the Protection of Industrial Property, which was held at Brussels last December, has been prepared by the Hon. Bellamy Storer, minister to Belgium, and Francis Forbes, the United States delegates to the conference. The conference was attended not only by delegates from 15 of the states of the union, but by representatives from seven states which have not yet entered the union, among them Germany and Japan.

The propositions for amendment of the convention, submitted by the United States, looking toward reciprocity in the matter of fees and the requirement of working, and the matter of inventions belonging to certain classes which are patentable in the United States but not in certain other countries, were held by the conference to be contrary to the general spirit of the convention, but several solutions of the difficulties complained of were suggested which would not be obnoxious to the convention, such as requiring of any inventor who has applied for a patent in a foreign country before applying in the United States, first, the payment of the same fees in the United States which are required in the foreign country in which application is made; second, the limitation of the patent granted in the United States to the invention protected by the foreign patent, and, third, providing that the patent be granted in the United States within the time within which working is required in the foreign country.

As the fees exacted in many foreign countries and the annual taxes on patents and the requirements of working the invention in each country in which it is patented are extremely onerous upon American inventors and manufacturers, it is believed to be but right that foreign inventors should not be permitted to obtain patents in the United States under easier conditions than they can in their own countries.

The proposition submitted by the United States for the purpose of removing any question as to the effect upon the right of priority of the amendment of an application found necessary in the progress of the examination into the novelty of the invention was favorably received, but was not incorporated in the convention, for the reason that it was believed unnecessary, it being the opinion of the conference that it was "incontestible that the restrictions given to the original description, during the preliminary examination, cannot prejudice the right of priority established by article 4." It had been generally understood that a United States inventor seeking to secure the benefits of the "delay of priority" of seven months under the convention must file in the foreign countries the application as originally filed here, instead of the application in the amended form in which it became a patent. Under the present understanding of the convention, the United States inventor, having complied with the requirements here, may at once offer his invention for sale in a foreign country, or otherwise bring it to the notice of manufacturers there, and yet on making application at any time within seven months from the date of his application here, obtain there a valid patent.

A proposition to so amend the convention that patents granted in the several countries shall be mutually independent, that is, that a patent granted for 14 years in one country shall not shorten the term of a patent subsequently in a country in which the normal term is 17 or 20 years, received the support of the United States delegates and was adopted by the conference.

The proposed extension of the "delay of priority" to one year, the proposition that patents worked to the extent required in the country of origin should not be forfeited for non-working in other countries for at least three years from the grant of the patent, and certain propositions relating to trademarks, were discussed very fully, but had to be left to be settled by correspondence. All of these propositions, excepting the particular proposition restricting the registration of trademarks, were favored by the United States delegates.

Among the papers submitted with the report is a statement of the inventions excluded from protection in a number of foreign countries and a statement of the requirements as to working the invention made in certain countries. In some countries the failure to manufacture the invention in the country within one year invalidates a patent granted on the invention. In others, two years, or even three years, are allowed and importation of goods made under the patent is prohibited. This means that the manufacturer of an American invention must establish factories in each of these countries or give up patent protection in them.

Representative Hicks, chairman of the House committee on patents has introduced a bill authorizing the president to appoint three commissioners, whose duty it shall be to revise and amend the laws of the United States concerning patents, trade and other marks, and trade or commercial names, which shall be in force at the time such commission shall make its final report, so far as the same relates to matters contained in or affected by the Convention for the Protection of Industrial Property concluded at Paris on March 20, 1883, the agreements under the convention concluded at Madrid in April, 1891, and the protocols adopted by the conference held under such convention at Brussels last year, and the treaties of the United States, and the laws of other nations relating to patents, trade and other marks, and trade or commercial names. The commission is to report to Congress at once, and the report shall be made to indicate any proposed change in the substance of existing law, and shall be accompanied by notes which shall briefly and clearly explain the reasons for proposed changes. The report shall also be accompanied by references to treaties and foreign laws relating to patents, trade and other marks, and trade or commercial names, which, in the opinion of the commissioners, may affect citizens of the United States.

Telegraph Tournament in New York.

Telegraph operators from all over the country contested for prizes at the electrical exposition in Madison Square Garden, New York, on Saturday. During the afternoon three classes tested their ability at sending and receiving messages from one of the anterooms of the concert hall in the building into the main auditorium. In all about 25 young women and men participated under the supervision of Frederick Catlin, a well-known expert operator. In the women's class, which required the sending of the greatest number of words within the period of five minutes, the first prize being $80 and the second $60, the winners were Miss J. McManus, employed by the Postal Telegraph company in New York, first; Miss Emma R. Vanselow, New York, second. In the class requiring the sending of 230 words within five minutes, the first prize was $90, and was won by Charles F. Edney of the Associated Press. F. M. McClintock of the Associated Press, Memphis, Tenn., won the second prize, $70. In the 240-words class J. D. Hinnant, employed by the Anglo-American Telegraph company, won the first prize, sending 252 words, and F. M. McClintock of Memphis, Tenn., won the second prize, sending 243 words. David C. Grant of the Toledo Commercial, Toledo, O., was highly commended in both the 230 and the 240-word classes.

There were only three entries in the code-sending class. These were G. W. Conkling, New York, who won by sending 345 words in five minutes; W. M. Gibson, New York, 330 words, and C. F. Edney, New York, 279 words. The title of champion sender was won by W. M. Gibson, who, without code abbreviations, sent 254 words in five minutes. Frank L. Catlin of Albany was second with 253½ words. Gibson broke the previous record of 248 words, made in 1893 by F. J. Kihm of Brooklyn.

The judges selected for the tournament were A. S. Brown, F. E. Jones, Charles Shirley, F. F. Austin, P. J. Tierney, E. W. H. Cogley, J. H. Bunnell, P. B. Delany, T. J. Smith, T. C. Martin, W. D. Weaver, J. B. Taltavall, G. H. Guy and Colonel A. B. Chandler. Additional interest was given to the occasion by the presence of Thomas A. Edison, who, as is well known, was a skillful telegrapher at one time of his life. He was prevailed upon to assist in the judging, although, as he laughingly confessed, he was of little practical use in that position, as the deafness from which he suffers prevented him from distinctly hearing the ticking of the receiving instrument.

American Institute of Electrical Engineers.

In compliance with the constitutional provision, the fifteenth annual business meeting of the American Institute of Electrical Engineers was held at 12 West Thirty-first street, New York, on Tuesday, May 17th, at 8 p. m. The annual report of council was presented, including the financial statements of the treasurer and secretary.

The annual election of officers was, of course, the principal event, and, as usual, it resulted in the election of the council ticket, which contained the following names:

President, Arthur E. Kennelly.

Vice-presidents, Robert B. Owens, William Stanley, Cary T. Hutchinson.

Managers, Herbert Lloyd, Samuel Sheldon, George F. Sever, Charles P. Steinmetz.

Secretary, Ralph W. Pope.

Treasurer, George A. Hamilton.

When the business had been transacted the members visited the electrical exposition at Madison Square Garden.

It was announced that applications had been received from the following candidates for associate membership, which will be acted upon by the council at its meeting June 22d:

Walter C. Allen, Washington, D. C.; Frank Henry Dexter, Ithaca, N. Y.; P. M. Downing, Blue Lakes City, Cal.; Joseph Lyons, Washington, D. C.; George A. Damon, Chicago, Ill.

Members who desire to present papers for the general meeting at Omaha, June 27-29, are requested to communicate with Herbert Laws Webb, 15 Dey street, chairman of the committee on papers and meetings, or with the secretary.

Surgery with a Magnet.

[From the Cleveland Leader.]

A physician of Canal Dover has just performed an extraordinary surgical operation by means of electricity. The patient is little Erma Wallick, the five-year-old daughter of Felix Wallick. The child in romping on the floor accidentally ran an ordinary sewing needle into her leg at the right knee-joint. In attempting to pull it out the father broke off the bit of steel, leaving more than half of it imbedded in the flesh, and when she was taken to the doctor repeated probing failed to locate the fragment of needle. At the latter's suggestion the child was taken to the power house of the Tuscarawas Electric company and placed on the dynamo in such a manner that the right knee-joint pressed against a powerful magnet of 125 horse power. The little tot was kept almost continuously in this position for eight hours. The treatment was heroic, but the joint had become so painful and swollen that the magnet treatment was resorted to in the extremity of saving the limb. This powerful force failed to draw the needle to the surface, and a smaller magnet connected with the dynamo and having its full force was made in such a form that it could be inserted in an incision at the joint. The baby was chloroformed, the leg laid open with the knife, and the magnet introduced. When it was withdrawn the troublesome bit of steel clung to it, and the experiment was a success.

The Pacific Cable Question.

[From the London Times of April 11th.]

The development of events in the Far East and the addition of Wei-hai-wei to the list of British posts on the Pacific lend special interest to the renewal of activity with regard to the construction of swifter means of communication between the scattered British communities. The Australian premiers in conference have agreed that if Great Britain and Canada will contribute two-thirds of the cost of a Pacific cable, Australasia should contribute one-third. In Canada an influential deputation has waited on the premier and laid before him a proposal that a Pacific cable trust should be created under authority of the parliaments interested in the scheme, with power to raise the necessary funds and proceed to the construction of the cable. In this country it is understood that as soon as the Australasian and Canadian colonies shall agree in manifesting a strong desire for the construction of the line, any proposal which they may make to that effect will receive at least favorable consideration.

The need for a Pacific cable is becoming every day more potent, and the rule which applies to all other commercial enterprises will no doubt hold good, that, when the advantages of a new opening have become fully apparent, if one man holds back another will certainly come forward to profit by the offered chance. That a Pacific cable will be made before long is hardly open to doubt. The question with which the imperial and colonial governments are playing is whether that Pacific cable shall be in British or in foreign hands. The position, very briefly summarized, is as follows: Commercial civilization has been spreading eastward and westward from its more active centers, till at both extremities its extension has reached the shores of the Pacific. It finds the largest ocean of the inhabited world as yet untraversed by a single line of telegraphic communication. When the West wishes to communicate with the East or the East with the West across the dividing water, the message has to be sent backwards round two hemispheres. Yet swift communication is the soul of commerce, and commerce is the soul of every flourishing modern community established on the shores of the Pacific. The British communities of Canada, Australia and New Zealand, the western states of America, the scattered island populations, now first coming to importance, are in their nature industrial before anything. The name of the East Indies is almost synonymous with trade. Japan has passed through an industrial second birth. Russia is pushing industrial enterprise on the northern Asiatic coast. France has not shrunk from heavy cost to establish a commercial footing on the south. Germany has made her latest move in the interests, we are asked to believe, of the protection of her commerce. Thus, north and south and east and west, the ocean is surrounded by rival nationalities. In presence of these waiting powers indications are given that the immense commercial field of China is about to be thrown open. Instantly the waters of the Pacific are alive. The military and political movements which have taken place are but the forerunners of other intercourse. To suppose that the competing communities will remain indefinitely without the means of telegraphic communication so essential to the success of individual aims is to ignore all the teachings of experience. Under the protection of one power or another, a cable connecting the lines of the eastern with the western and of the southern with the northern continents will certainly be made. All that is doubtful is whether that power will be British. We have declared our policy in those seas to be commercial. Here is a step of evident commercial advantage to

be taken, and as the matter at present stands the most decided utterance which appears to have been made upon the subject is to be found in a communication received by the Hawaiian government in the first week of February, to the effect that the French cable connecting Australia, via New Caledonia, Tahiti and the Sandwich Islands, with San Francisco will immediately be laid. If this information is correct, such a Pacific cable would, of course, be under the immediate control of France and the United States.

The cost of an all-British cable connecting Canada with Australasia would be about £1,500,000. The construction has been tendered for by competent contractors at that figure. It has been estimated that a diversion of less than half the existing telegraphic business of Australasia with the northern hemisphere to its line would render it fully self-supporting, and as the telegraphic business of Australasia, which is rapidly increasing, would of necessity be stimulated by increased facilities for communication with growing markets, the presumption is that a great deal more than the required quantity would in the course of a few years pass over the Pacific cable. The trunk line of cable once established, branch lines can easily be constructed to connect it with important points. One terminus under British protection in Australasia and another in Canada, one branch, if necessary, to join the San Francisco connection with Hawaii and another to Japan and the China ports, would create a British network of cable communication which would for a long time to come meet the principal commercial needs of the Pacific. Interest at three per cent. on the whole initial cost of the Canadian and Australian line would be covered by £50,000 a year. To guarantee working expenses and the necessary loan would in no circumstances entail more than a trifling expense upon the guaranteeing governments, and if the apparently reasonable anticipation of commercial success prove to be well founded there will be substantial profit. The benefit to British commercial interests cannot be a question of doubt. The most practical proposal which has been formulated for consideration is that the five governments of Canada, New Zealand, New South Wales, Victoria and Queensland, or any four of them, shall enter into a joint arrangement for establishing an electric cable across the Pacific, sharing equally in costs and profits, and that the imperial government shall be invited to guarantee or lend one-third of the capital, or assist in such manner as the home authorities may determine. The original suggestion in connection with this scheme was that, if it were accepted, the official representatives of the colonies in London should be charged with the duty of ascertaining how best to carry out the proposal. The present proposal would appear to be that, in the event of the acceptance of this or some alternative scheme, a trust should be formed for the purpose of carrying it into effect.

It has been the fashion to treat the Pacific-cable scheme as one of impressive magnitude. As a matter of fact, it is a scheme of wide utility, but of financial dimensions so modest that one rich man could proceed to the construction of the cable out of the resources of a private fortune. The matter might, indeed, be safely left to the operation of private interest but for the fact that in the present somewhat exceptional condition of affairs, when all eyes are turned to the Far East, time may become a question of importance. The first Pacific cable has not only the best chance of being successful in itself; it must also have the effect of delaying the construction of rival lines. If the British cable is to hold the field, it should be made without delay.

Stationary Motors on Trolley Circuits.

In enforcing the city ordinance relating to safe wiring, Mr. Ellicott, the city electrician of Chicago, has encountered the opposition of the Chicago General Railway company, which, it was claimed, was supplying 500-volt current to stationary motors from its grounded trolley circuits. This practice, as is generally known, is condemned as dangerous by the city authorities and insurance men, and it is stated that on several occasions the attention of the company was called to it by representatives of the city electrical department, with the warning that it must be stopped. A motor recently installed in a machine shop was the particular object of controversy. It was claimed that this motor was operated on the railroad company's grounded circuit, and the opportunity of inspecting it was demanded. This demand was opposed by the company, and in consequence Mr. Ellicott caused the cutting of the circuit leading to the machine shop from the trolley circuit. The company held that this was an unwarranted and unlawful act, and the city electrician was cited to appear in court to give a bond to preserve the peace. Mr. Ellicott's defense was undertaken by the city law department, and when the case came to a hearing before Judge Dunne it was decided that no offense had been committed. It seems, therefore, that the city is well within its rights in using extreme measures to prohibit the tempting but reprehensible practice of operating 500-volt motors on grounded circuits.

G. Willius, Jr., of St Paul will prepare plans for an electric-lighting plant for the city of West Superior, Wis.

CORRESPONDENCE.

New York Notes.

New York, May 16.—Apropos of the prominent part taken by the Edison Illuminating company in the electrical exhibition, it is interesting to note that from its six principal stations this company is supplying more than 7,500 customers, 370,000 incandescent and 5,000 arc lamps, and 20,600 horse power in electric motors; in all an equivalent of 726,000 lamps of 16 candle power each—the largest electric-lighting and power system in the world.

In the course of an instructive paper recently read before the Railroad Club of this city, George Gibbs gave some interesting facts about the electrical distribution of power in the Baldwin locomotive shops at Philadelphia. Electric power was first introduced in 1890, and now there are 215 motors, rated from two to 50 horse power each, and averaging nine horse power each for the entire number. The aggregate horse power in motors is 1,930. The total generator capacity installed is 700 horse power, and the daily average horse power at the switchboard is about 570, which is fairly constant throughout the day. The force of workmen needed to keep up all line repairs, inspecting and repairs on the 215 motors, and on ten arc dynamos and four power generators, consist of two men, with one-third of the time of another. One of these men alone keeps up repairs on armatures. The labor cost averages $6 per day, and the new material consumed in repairs is estimated to cost about $2 per day. The total labor and material cost per year is therefore about $2,500, or about four per cent. on the first cost of the plant. The plant is regarded as entirely satisfactory, and is being constantly extended.

The Holland, the submarine torpedo boat with the storage-battery equipment, is still undergoing test. The naval authorities are reported to be satisfied with the diving and steering capacity of the boat and her seaworthiness, but they desire to see the Whitehead torpedo-explosion tube tested with real ammunition. For this purpose a live torpedo with a practice head will be furnished by the government and will be discharged in the presence of a committee appointed by Secretary Long. The French government is said to be still trying to secure the Holland, but the owner naturally wishes to place her in the service of the United States.

A very unusual accident caused the death of William Claypool, a wireman employed by the Brooklyn Heights Railroad company, on Saturday afternoon. Mr. Claypool was conductor on a flat repair car. At the switch between First and Second avenues the trolley left the wire and caught in the frog overhead. The trolley wire above was pulled taut with the strain, and the trolley pole was also under a strain. Claypool went to the upright iron post which forms the base for the trolley pole on the flat car, and was trying to loosen the trolley from the frog, when suddenly the coiled spring on top of the iron post snapped, and a strand of it wrapped around Claypole's throat, his head being close to the spring at the time. The sharp end of the steel cut into Claypool's neck and slowly strangled him to death. He became unconscious before he was removed from the clutch of the broken spring, and died soon after the ambulance surgeon arrived. Claypool was 24 years old, lived at Fourth avenue and Ninety-fourth street, and had a wife and child. Stacom, the motorman, was arrested, although he does not appear to have been responsible for the accident. M. S.

Northwestern Notations.

Minneapolis, May 16.—The Citizens' Traction company of Oshkosh, Wis., has let the contract of the Falk Manufacturing company of Milwaukee, to extend its lines to Summer Park.

It is reported that H. M. Byllesby of St. Paul is working to secure the water power of the St. Louis River above Duluth, Minn., and develop power to be transmitted to Duluth and Superior by electricity.

A council committee of Perham, Minn., will investigate the matter of electric lights

Baker & Lord have been granted a franchise through the town of Farmington for their proposed electric line from Waupaca, Wis., to the Chain o' Lakes. C.

National Electric Light Convention, Chicago, June 7th, 8th and 9th.

The most popular line from Cincinnati, Louisville and all points South to Chicago is the Big Four Route via Indianapolis; magnificent sleeping cars and unequaled dining-car service. For maps, rates, etc., address E. O. McCormick, passenger traffic manager, Big Four Route, Cincinnati, O.

PERSONAL.

Mr. J. Appleton, the chief engineer of the construction department of the Electric Storage Battery company of Philadelphia, was in Chicago during the week, inspecting the work on the large battery now installed in the Adams street station of the Chicago Edison company.

Mr. E. B. Ellicott, the city electrician of Chicago, is still receiving the congratulations of his friends on the occasion of his recent marriage to Miss Minerva Ellsworth. Miss Ellsworth was a resident of Milwaukee, and she became Mrs. Ellicott in Plymouth Church at that city on the evening of April 26th. A large number of friends witnessed the ceremony. Mr. H. R. Hixson of Chicago was one of the ushers. Mr. and Mrs. Ellicott are now residing at the Chicago Beach Hotel.

ELECTRIC LIGHTING.

The city of Jacksonville, Fla., is to have increased electric-light facilities. It became apparent some months ago that the lighting plant was inadequate to supply the demand for lights, and it was then decided to double the capacity of the plant and also to introduce a day lighting-power service. These improvements are being pushed rapidly to completion, and it is expected that the new lights will be ready in a few days. Superintendent Patterson, in his electric-light report for 1897, recently submitted, stated that there had been an increase of receipts over those of 1896 of 22 per cent., and that the profits accruing to the plant during 1897 were $20,468.

ELECTRIC RAILWAYS.

Mr. McGann, the commissioner of public works of Chicago, has issued a permit to the Calumet Electric Street Railway company to build a trolley loop on Stony Island avenue, between Sixty-third and Sixty-fourth streets, across private property, in accordance with the ordinance passed by the council on March 28th.

The project for building an electric road from Rochester, N. Y., to Sodus Point has been revived, and there is some probability that the tracks will be laid shortly. Men who are interested in having the road built are Joseph C. Tone, Ira M. Luddington, Charles Van Voorhis and others. The prospective route into Rochester is by way of Clifford street to North St. Paul street.

The Rochester, N. Y., Railway company has discontinued selling six tickets for a quarter. At a meeting held May 10th Manager Nicholl called the attention of the directors to the fact that the receipts of the company were falling off, on account of the inroads made by the bicycle. A city ordinance requires the company to pay for the construction and repair of that portion of the street pavement between the rails and for two feet outside. This expense, it is estimated, will amount to about $75,000 this year.

The lease of the Rochester and Irondequoit Railway company's Summerville line to the Rochester, N. Y., Railway company is announced, the period of the lease being 10 years from April 15, 1898. The agreement is dated May 10th. The Rochester Railway company is to pay the lessor $8,000 a year in four installments of $2,000 each, the dates of payment being the 15th of June, July, August and September. If the earnings exceed $20,000 a year, 50 per cent of the excess amount will also be paid the lessor. The lease includes the Summerville ferry and the Windsor Beach picnic grounds, the lessor reserving the right to sell the grounds any time during the continuance of the lease.

TECHNICAL SCHOOLS.

The "Bulletin" of the College of Engineering and the Mechanic Arts of the University of Minnesota shows that during the school year now closing lectures on electrical subjects have been given by the following-named non-resident engineers: William I. Gray, Minneapolis, "Two hundred and twenty-volt Plants;" Edwin Reid, New York, "Underground Wires and Cables;" O. B. Playter, St. Paul, "Arrangement of Electric Plants." The courses of the college are open to all persons over 14 years of age free of all charge for instruction. The admission examinations are held on the last two days in August and the first two in September. George D. Shepardson is the professor of electrical engineering.

MISCELLANEOUS.

A new contract has been made between Robert G. Reid of Montreal and the government of Newfoundland, by which the former obtains complete control of all telegraph and telephone lines in the colony until April 15, 1904. Mr. Reid assumes all cost of maintenance and operation, and will receive all earnings and profits during that time, the government agreeing to pay $10,000 annually for service. He has also agreed to construct and operate an electric railroad in the town of St. John, or to see that it is done.

TRADE NEWS.

Mr. John Rice, who is so well and favorably known to the carbon consuming trade as the popular salesman of the National Carbon company of Cleveland, O., severed his connection with that company on the 15th instant, and has accepted a similar position with the Phœnix Carbon Manufacturing company of St. Louis. Mr. Rice's friends wish him every success in his new home in St Louis.

BUSINESS.

The Western Electric company claims for its alternating-current fan motors minimum attention, light weight, variable 'breeze, substantial construction, quiet running, pleasing appearance and high efficiency. The motors are of the induction type. The company's Bulletin 1 F describes them briefly.

The Boulder Electric Light company of Boulder, Colo., which has a number of Ball engines in satisfactory use, has recently ordered from the maker, the Ball Engine company, Erie, Pa., a 100 horse power engine arranged for direct connection to a 60-kilowatt General Electric machine. It is noted, also, that the Peruna Drug Manufacturing company Columbus, Ohio, has recently ordered from the Ball Engine company, Erie, Pa., and the Siemens & Halske Electric company, Chicago, two 150 horse power Ball engines direct-connected to 75-kilowatt generators, and one 225 horse power engine, direct-connected to a 150-kilowatt generator.

The Illinois Electric company has found it necessary to lease the entire basement at 239 Madison street, Chicago, 50 by 150 feet, with a large freight elevator in the rear. The company will carry in stock a large line of cross-arms, cross-arm braces, pins and brackets, lag screws, pole steps, etc., and will be able to fill orders on the day they are received.

Compartments on the New Pennsylvania Limited insure all the exclusiveness afforded by rooms in hotel or home. The finish of the compartments presents something entirely new in inlaid woods. The New Pennsylvania Limited leaves Chicago Union Station daily over the Pennsylvania Short Lines at 5:30 p. m. Space will be reserved upon application to H. R. Dering, assistant general passenger agent, 248 South Clark street, Chicago.

The new power station and car-house being erected by the Spencer, Warren and Brookfield Street Railway company at Brookfield, Mass., will have steel roof trusses and covering furnished by the Berlin Iron Bridge company of East Berlin, Conn. The dynamo and engine-room roofs of this building will be lined with the Berlin company's patent anti-condensation roof lining, which prevents the condensation of moisture from the underside of the roof covering, which, if it should collect and drop upon the machine beneath, would cause considerable damage.

ILLUSTRATED ELECTRICAL PATENT RECORD.

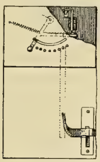
Issued May 10, 1898

603,623. Conduit Wiring Machine. William E. Cowan, Brooklyn, N. Y. Application filed August 27, 1897.

A guide section with runners, a rope-carrying section, a rod and clutches are utilized, whereby each of the sections may be rigidly attached to the interior of a conduit, and means provided whereby the sections may be alternately introduced within the conduit by means of the rod, and means whereby the clutches can be withdrawn from contact with the conduit.

603,624. Electric Railway. Eben C. Crocker, Bridgeport, Conn. Application filed September 17, 1897.

In an electric-railway system comprising a supply conductor, insulated power collecting sections, and a power collector carried by the car, the combination is claimed of the two series of magnets composed respectively of single magnets and pair magnets arranged opposite to each other and connected in separate branch circuits comprising one of the single magnets and two magnets selected from the pair magnets which immediately succeed and precede the single magnet in each instance, the insulated sections and the car rail with which the terminals of the circuits are connected, the armatures within the fields of the oppositely arranged magnets and carrying switches, the insulated contacts connected respectively with the power collecting sections and with the supply conductor, and the storage battery carried by the car and operating through the sections to energize the magnets whereby the switches are operated.



NO. 603,681.

603,625. Electric Railway. Eben C. Crocker and Edwin C. Howe, Bridgeport, Conn. Application filed September 17, 1897.

This electric-railway system comprises a supply conductor, insulated third-rail sections, and a power collector carried by the car, the two series of magnets comprising pairs of separate magnets arranged opposite each other, single magnets selected from each quarternate couplet of one series being connected in circuit with single magnets selected from alternate couplets of the other series intervening between the quarternate couplets, whereby branch circuits are formed, and connections with the conductor and sections through intermediate circuit closers and breakers operated by the magnets whereby the section having contact with the collector is in closed circuit while the sections immediately succeeding and preceding are in circuits capable of being closed by the collector.

603,630. Electric Arc Lamp. Frederick A. Gilbert, Brookline, and Emil O. Lundin, Beachmont, Mass. Application filed July 1, 1897.

A feed-controlling clutch including rotatable members to directly engage the carbon, rocking carriers for the members, brakes mounted on the carriers to prevent rotation of and press the members against the carbon, and an actuator to operate the carriers and control the brakes to thereby raise and lower the clutch bodily.

603,650. Automatic Electric Feed-water Regulator. Andrew E. Maccoun and John Noey, Braddock, Pa. Application filed December 3, 1897.

In a feed-water regulator for steam boilers a cylinder is connected with a boiler and a float is arranged in the cylinder upon one end of a lever; a vertically movable rod is secured to the other end of the lever and carrying a pair of contact points, and a standard is mounted upon the top of the cylinder carrying two pairs of contact points and having arms in which the rod is guided, the two solenoids having electrical connection with the two pairs of contact points and adapted to close or open a feed-water pipe valve.

603,672. Trolley Device for Electric-railway Cars. Louis E. Walkins, Springfield, Mass. Application filed April 14, 1897.

The combination is described with an overhead support or conduit having upper and lower ways or conductors of a trolley having a wheeled body running on the lower conductor or way and having a spring supported shoe to run with an upwardly bearing pressure on and along the upper conductor, the car having upright arms, one in advance of the other, each pivotally connected on the car for a fore-and-aft vibration, and each having adjacent its pivot an angular arm cushion above and below the arms and connections between the arms and the ends of the trolley body.

603,681. Throw-off Switch for Telephones. Nathan Fallek, San Francisco, Cal. Application filed August 17, 1897.

The combination with the pivotally attached switch lever of the spring, the ratchet-toothed bar, the sliding-dog, spring arm, pivoted lever, pivoted piece on the end of lever and the arm on the telephone hook having the inclines on the end to engage the inclines on the piece.

603,687. Electric Arc Lamp. John H. J. Haines, New York, N. Y. Application filed May 27, 1897.

The outer globe is supported on the annular base plate, the removable ring sustaining the globe, the arc-inclosing chamber mounted directly upon the plate over the opening therein, and a removable plate closing the opening and carrying the lower carbon holder.

603,696. Automatic Temperature Regulating Apparatus. Walter B. Loring, Worcester, Mass. Application filed November 5, 1896.

In combination with a heat-controlling damper a motor is operated by electricity, and a switch mechanism is adapted to be operated automatically by the revolution of the shaft to automatically cause the electric current to pass in one direction or the other through the field coil, to operate the armature and the shaft in one direction or the other, and move the damper.

603,705. Electric Incandescent Lamp. William J. Phelps, Chicago, Ill. Application filed September 7, 1897.

A constant-potential electric lamp comprising a vacuum bulb and two incandescing filaments, differing in resistance per unit of length, connected to receive current in series, but not otherwise or separately, the resistance of the filaments being such that one glows while the other serves as a relatively dark and dead resistance to modify the current.

603,709. Dynamo or Motor. Ferdinand Schwedtmann, St. Louis, Mo. Application filed October 23, 1897.

In a dynamo or motor, a suitable casing or housing for the field-magnet core cast in one piece, a laminated field-magnet core inserted in the casing from the bottom, and means for rigidly securing the core in the casing.

603,722. Electric Condenser. Charles S. Bradley, Avon, N. Y. Application filed July 29, 1897.

An electric condenser having its several plates separated by a fibrous insulating material, the pores and meshes of which are filled with stearate of lead.

603,745. Underground Conduit for Electric Conductors. Charles H. Sewall, Chicago, Ill. Application filed May 8, 1895.

A conduit duct for electrical conductors is described consisting of a smooth flat floor of indefinite length, the floor being a composite made by embedding a metallic frame in cement, concrete or other like plastic material, whereby the concrete acts as a resistance to compressive strain and the iron wires as resistance to tensile strain, and upon which are superimposed in sections inverted channels placed end to end.

603,815. Electro-therapeutic Apparatus. Gervaise G. Duke, Chicago, Ill. Application filed December 6, 1897.

Claim is made for the combination of an open-ended metallic casing provided with a jet orifice or orifices and with a marginal flange of insulating material, an outlet tube leading from the casing inside of the flange and a primary battery or other source of electrical supply, one terminal of which is electrically connected with the metallic casing, and the other terminal of which is provided with an electrode.

NO. 603,875.

603,849. Switch for Electric Motors. Frank E. Herdman, Winnetka, Ill. Application filed January 9, 1897.

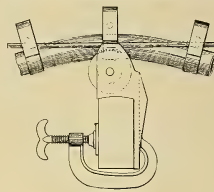
A switch is interposed between the source of current supply and the motor, one portion of the switch being adapted to make electrical connection with the source of current supply, the other portion being adapted to make electrical connection with the armature, and both portions of the switch being adapted to make electrical connection with the field, means to operate the switch to move the portion of the switch connecting with the current supply to and from central position without moving the other portion of the switch.

603,875. Electrical Apparatus for Schools. Melvin E. Crowell, Indianapolis, Ind. Application filed November 23, 1896.

This invention is described as apparatus for teaching electricity, comprising a base plate, a pillow block with a sleeve extending therefrom, an armature shaft mounted in such pillow block and sleeve, a driving pulley mounted on such shaft, an armature adapted to be removably mounted on such shaft, a lower pole-piece with a pair of posts extending therefrom, a pair of coils that fit over such posts and have suitable binding screws, an upper pole piece detachably secured to the posts on the lower pole piece, a commutator, commutator brushes removably mounted on the pillow block sleeve, an L-shaped bar with one end secured to a sleeve adapted to be carried loosely on the armature shaft and having a key at its free end and a binding screw at its other end, a clamping collar adapted to be mounted on the pillow block sleeve, a spiral spring surrounding the sleeve to which the L-shaped bar is attached and secured at one end to such collar and at the other end to the bar, an armature secured to the bar over the posts on the lower pole piece, and a post mounted in the base plate having two parallel arms, one above and one below such L-shaped bar, with a set-screw in the upper one, whereby a dynamo or telegraph sounder may be made.

603,882. Electric Lantern. Frederick G. W. J. Adams, London, England. Application filed April 24, 1897. Patented in England July 7, 1891, and in France April 18, 1893.

The battery casing consists of the case having integral therewith partitions and blocks at the bottom rim and grooves in front for receiving a sliding plate overlapping the cover, provided with metal strap with longitudinal recess, means for securing the cover to the case and a handle.



NO. 603,991.

603,886. Electrical Steering Apparatus. Harry O. F. Bindemann, Madrid, Spain. Application filed June 4, 1897.

Motors rotating in opposite directions and clutches for operatively connecting the rudder with either of the motors are combined with an axle or pivot adapted to be turned by the man at the wheel, a switch arm capable of a limited rotary movement relatively to the pivot, and having an inclined surface, a pin projecting from the pivot and engaging the inclined surface, a spring for keeping the pin against the inclined surface, contact devices arranged to be engaged by the switch arm and electrically connected to the clutches, and means for holding the rudder stationary after it has reached the desired position.

603,890. Primary Element with Regenerable Negative Electrode. Oskar Rothmund Edler von Burgwall and Leopold Ofenschüssl, Vienna, Austria-Hungary. Application filed December 9, 1896. Patented in Germany October 25, 1896, and in Austria November 9, 1896.

The process of manufacturing negative electrodes for primary batteries consisting in first preparing a peroxide plate of porous peroxide of lead on a lead frame, then freeing this plate of air and moisture, then impregnating the peroxide with a water soluble concentrated electrolyte and then partially drying the electrodes so that they present dry surfaces.

603,927. Means for Suspending Motors on Vehicles. Sidney H. Short, Cleveland, Ohio. Application filed February 25, 1898.

The combination with a wheeled vehicle of an alinement frame mounted on a driven axle, a motor journaled in the arms thereof, the weight of the motor being partially borne by springs interposed between the same and the alinement frame and by a rigid support extending to the truck frame and inelastically supported thereby.

603,991. Cable Stringer. Frank A. Cannon, Denver, Colo. Application filed December 3, 1897.

Suitable means are provided for supporting the cable and suspension wire; a bracket is adapted to be attached and a roller journaled on the bracket and adapted to engage the cable, the bracket being provided adjacent the roller with a ledge for supporting the suspension wire.

603,786. Electrically Controlled Switch. Edward M. Hewlett, Schenectady, N. Y. Application filed January 23, 1897.

The last claim is given: In a solenoid magnet, the combination of an inclosing casing and energizing coil, a cylindrical, straight-bored core, a removable cap having a central opening, the metal surrounding the opening having an increased cross section to provide a good magnetic circuit, a cylindrical movable core comprising two parts differing in their cross-section, and a piece of non-magnetic material arranged to guide the movable core within the stationary hollow core and prevent them from sticking.

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Electrical Production of Ozone.

Since the abandonment of the plant for the electrical production of ozone at Marseilles, Ill., the experiments in this direction seem to have been carried on with much greater energy in England than in this country. The American plant was built with the idea of producing ozone to be sold for bleaching processes of all kinds, treating drinking waters and sewage, "ageing" spirits, separating sugar in sugar refining, as a preservative of milk, meat, etc., as a medicinal agent, and for many other useful purposes. The process of Ernst Fahrig was used, and while the plant seemed to be a scientific success, it did not meet the expectation of its promoters from a commercial point of view, and the work was discontinued several years ago.

The Fahrig process was described at some length in the Western Electrician of August 27, 1892. It consisted, essentially, of chemically producing oxygen, which was then passed through the electric discharge of a condenser attached to a transformer having a calculated electromotive force in the secondary winding of 40,000 volts. The ozone was produced by the action of the electrical discharge in the oxygen, and it was piped from the ozonizing generators to suitable receptacles.

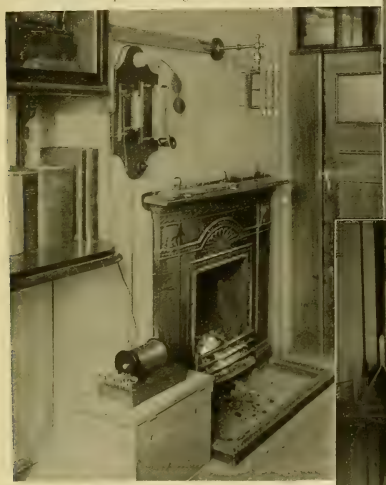

Fig. 1. Ozonizer and Inhaler for Ward Movement, with Ruhmkorff Coil and Leclanche Battery.

It is now well recognized that ozone is best made by the action of the electric spark on oxygen, although chemical processes were formerly employed to a limited extent. A number of scientists and engineers have worked in the direction of devising practical and efficient apparatus for producing the greatest amount of ozone from a given amount of electrical energy. Among them Emile Andreoli, in England, has been particularly active and persevering. He prepared a small book, entitled "Ozone, Its Commercial Production and its Applications," which was published in 1893, and he delivered a lecture on the same subject a little over a year ago, before the Society of Chemical Industry, which showed considerable advance. Mr. Andreoli has devised several forms of ozonizers. He is the technical manager of a London company which manufactures electrical ozone-generating machines, and several types of his interesting apparatus are illustrated herewith. He states that, theoretically, the expenditure of one electrical horse power hour should result in a kilogramme of ozone, but there is a wide divergence between theory and practice. He is now able to produce 130 grammes of ozone per kilowatt-hour in his latest ozonizer, and he is still seeking better results. The essential qualities of a good ozonizer, it is stated, are durability, easy construction and efficiency.

Mr. Andreoli has two classes of ozonizers—one in which the vacuum tube is an essential feature, and another, designed for larger sizes and the industrial production of ozone, consisting of grids formed of serrated wires and flat electrodes.

The first class is intended to be used principally for medical and sanitary purposes. The vacuum tube contains a metallic rod surrounded by an aluminum armature. When the current from a coil is used. A laboratory ozonizer, working with a small Miller & Wood transformer, is illustrated in Fig. 3.

A reproduction of a photograph of four of the ozonizing tubes, taken in a dark room, is given in Fig. 4. (This and succeeding pictures are on pages 306 to 309.) This set of open ozonizers is actuated by the current from a transformer which raises the current supplied from the street mains of the city of London Electric Lighting company from 100 volts to 4,000 volts.

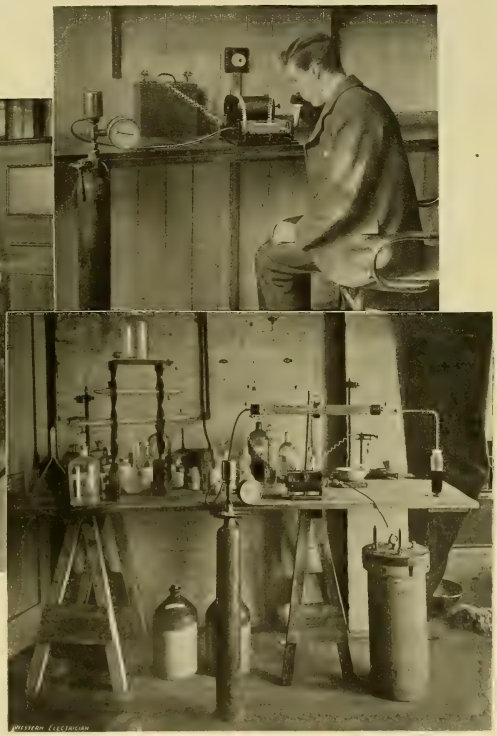

Fig. 2. Inhaler and Secondary Battery and Ruhmkorff Coil, used for Ozonizing Oxygen.
Fig. 3. Laboratory Ozonizer with Small Transformer.
ELECTRICAL PRODUCTION OF OZONE

Ruhmkorff coil or from a 3,000 to 5,000-volt transformer is sent through it, the coil becomes luminous and ozone is generated around it. These small ozonizers are intended for domestic or laboratory use. They are very compact and are said to be efficient. Fig. 1, in the large group of illustrations, shows an ozonizer of this class arranged with an inhaler for household or office use. The apparatus is fixed on a board and is worked with a Leclanche battery and a Ruhmkorff coil. Fig. 2 represents a modification of the same type. In this case, oxygen, and not atmospheric air, supplies the "raw material" for the ozone, which is used from an inhaler, as the picture clearly indicates. A storage battery here supplies the current, and a Ruhmkorff

Eminent physicians have prescribed ozone in many cases. Ozonized oxygen insufflated on wounds produces a remarkably beneficial action. Ulcers which had resisted every other treatment began to heal at once, the wounds rapidly filling with healthy tissue. In rooms, ozone purifies the air. Many consumptive people have been benefited by inhalation of ozonized oxygen; the essential point is not to administer ozone in extremis.

The second type of ozonizer devised by Mr. Andreoli is especially interesting from an industrial point of view. It consists, essentially, of grids formed of aluminum serrated wires and of flat aluminum electrodes. These are kept separated by sheets of glass, and the whole of the plates and

grids are held together by means of wooden clamps. The construction is extremely simple. No skilled labor is required either to make an installation or to superintend it. There cannot be any uncertainty or disappointment about the regular working of an installation, however large it may be, since if a given quantity of ozone is produced by a given surface of electrodes of an ozonizer with a given expenditure of electrical energy per hour, the number of similar ozonizers required to obtain a desired quantity of ozone in any time is readily obtained. These commercial ozonizers produce about 125 grammes of ozone per kilowatt, and are especially designed for industrial applications.

The special feature of this ozonizer is that the yield of ozone is increased very considerably. There is no circulation of water for cooling purposes. The generation of excessive heat by the electric effluvia on the dielectrics and electrodes is avoided. The electrodes of this form of ozonizer are point-bearing grids facing flat electrodes. The point-

FIG. 4. ELECTRICAL PRODUCTION OF OZONE.—LUMINOUS TUBES OF OZONIZER, PHOTOGRAPHED IN DARK ROOM.

bearing grids are composed of a number of serrated wires mounted on rods running through them and kept separated by washers. Fig. 5 shows one of the grids. There are 80 rows of serrated wires, each having 222 points, making a total of 17,760 points on both sides. This is sufficient to show how with moderately high frequency and a low tension it is possible to obtain a feebly luminous glow and discharge sufficient to bring about the formation of ozone without the production of nitrous compounds, so to speak, or rise of temperature, which would affect the yield of ozone. The flat electrodes are made of boards of wood, which are plane and true, and on the two sides of which are fixed thin sheets of aluminum. In this way perfectly even and plane plates at a moderate cost are obtained. Instead of metal sheets, layers of metal can be obtained by electroplating. An insulating material, such as glass, is used to separate the electrodes. This grid is two feet square. All the serrated wires should be parallel, although some are shown bent out of shape in the picture.

Fig. 6 represents one of the grids with a glass sheet behind it, which serves to separate the grid from the flat electrode. It is placed against a wooden frame, which is coated with some insulating material, and which serves to keep the dielectric plates and electrodes together. Next to this is a flat electrode which is made of wood and two thin sheets of aluminum. In Fig. 7 five grids and six flat electrodes are shown mounted in the frame. This arrangement gives 80 square feet of surface.

The following are the advantages claimed for this method of constructing and working open ozonizers for the production in a continuous process of large quantities of ozone in chambers and its supply from such reservoirs: (1) No separate air-tight box or receptacle being required for each set of electrodes or ozonizers, there is a saving in cost and labor. (2) The apparatus can be worked continuously because it cannot get out of order or seriously heat. (3) Only one inlet for the air and one outlet for the ozonized air are required for a number of open apparatuses simultaneously electrified in ozone chambers, while a complicated series of pipes is unavoidable when closed ozonizers are used. Therefore not only can the air be distributed at the same rate of velocity over the whole range of electrodes of the open ozonizers, but the cost of separate pipes for the inlet and outlet of each closed ozonizer is avoided. (4) The working of the whole of the ozonizers can be controlled, which is not possible when several ozonizers are enclosed in separate air-tight cases. (5) In case of accident, or in case cleaning is required, the apparatus can be quickly taken to pieces and put together again. Any desirable number of ozonizers may be arranged in a chamber, according to the size of the chamber, or several ozone chambers may be used, each containing a number of open ozonizers, according to the electric current which is used for each set of electrodes.

Examples of the "open" ozonizers are shown in Figs. 8 and 9. The former represents a small ozone generator having 48 square feet of surface, and the latter an ozonizer having dimensions of 60 by 40 by 40 inches and 650 square feet of surface. The large generator is enclosed in a box and is supplied with current through a Crompton transformer.

Ozone installations consist of an alternating-current dynamo or other source of alternating current, one or more step-up transformers, and of one or several ozonizers, according to the quantity of ozone it is required to produce. The cost of a 500-watt installation, capable of yielding about 60 grammes of ozone per hour, is placed by Mr. Andreoli at about $700, including also an ozone chamber, measuring instruments, cables, switches, etc.

The commercial uses of ozone, if it can be produced cheaply in quantity, are manifold. It is an oxidizing agent par excellence, and is valuable in the many industries where oxidation is a feature. It contains nothing but oxygen, and so can be used for oxidation without danger of adulterating or injuring the substance to which it is applied. The only question is the commercial practicability of the production, and Mr. Andreoli claims to have made satisfactory progress in this direction. In addition to the applications mentioned in the first paragraph of this article, it is stated that ozone is adapted for drying and deodorizing fish and other oils, for seasoning wood and for purifying starch and edible fats. The sterilization of impure water is also a very important use of the disinfecting properties of ozone. On another page of this issue of the Western Electrician is an article describing the treatment of the water of the river Seine.

American Institute of Electrical Engineers.

At the annual meeting of the Institute last week a membership of 1,098 was reported and a treasurer's balance of $1,453.09. It was stated that the important committee on the standardization of dynamos, motors and transformers, consisting of F. B. Crocker, Cary T. Hutchinson, A. E. Kennelly, J. W. Lieb, Jr., C. P. Steinmetz, L. B. Stillwell and

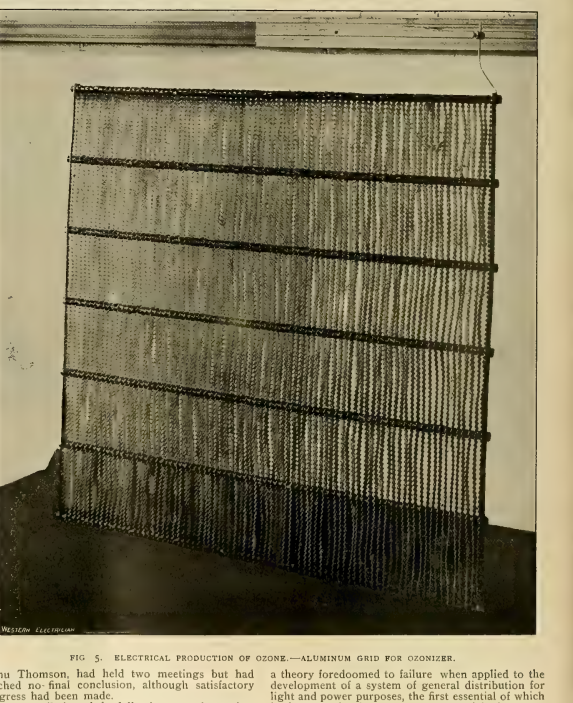

FIG 5. ELECTRICAL PRODUCTION OF OZONE.—ALUMINUM GRID FOR OZONIZER.

Elihu Thomson, had held two meetings but had reached no final conclusion, although satisfactory progress had been made.

The council elected the following-named associate members: F. L. Cadon, Washington, Ind.; Thomas Dempster, Schenectady, N. Y.; Paul Letheule (electrical engineer commissioned by French government), Schenectady, N. Y.; Livingston Johnston, Jr., Islip, N. Y.; Howard Joslyn, Seattle, Wash.; James J. Mahony, New York, N. Y.; Irving A. Taylor, Brooklyn, N. Y.; Wallace Rupert Turnbull, East Orange, N. J.; James H. Winfield, New Glasgow, N. S.; Fred. W. Wood, Los Angeles, Cal.

The following-named associate members were transferred to membership: Edward Burch, Minneapolis, Minn.; G. A. Redman, Rochester, N. Y.; L. S. Boggs, Ogden, Utah; Gustave J. Fischer, Sydney, N. S. W.; James B. Scott, Baltimore, Md.

Development of the Central Station.[1]

By Samuel Insull.

Part I.

When requested a short time ago by the chief of the electrical department of this university to deliver a lecture on some subject connected with central-station work, I must confess to having had some misgivings in accepting the honor to appear before you this evening, remembering the disadvantages that a commercial man invariably feels in discussing technical matters before those having had technical training, but then I remembered that even within my own time (and I think I can still claim to be a young man) very little was known of the general distribution of electrical energy from a central station, and when I recalled that so recently as the early '80's it was necessarily the rule for "guessing to be a substitute for mathematics" (to use the words of the great pioneer in central-station work), my misgivings were inclined to disappear, and I felt encouraged to talk to you on the development of the central station from the point of view of my own experience in following this, the latest of the great industrial developments of the wonderful era in which we live.

In referring to the development of the central station, it would hardly seem necessary to go at length into the history of the business, the origin of which probably dates from the work of the early experimenters whose efforts were directed to the perfection of series arc lighting. While their work is entitled to the greatest possible praise, it should be remembered that the theory on which they worked, namely, constant current and varying potential, is a theory foredoomed to failure when applied to the development of a system of general distribution for light and power purposes, the first essential of which is the necessity for a constant potential, the quantity of current varying in accordance with the demands made by those desiring to use the energy, whether for light or power purposes. Nor does it seem to me a matter very pertinent to the present occasion to trace the rival claims as to priority of invention of the early experimenters on incandescents lamps. Which of them was the first to produce a lamp that could be brought to a state of incandescence by means of the electric current is hardly within the scope of our inquiry. Probably all of them, groping in the dark (now and then illumined by the flashes of light emitted from their experi-

1. Lecture delivered before the Electrical Engineering Department of Purdue University, Lafayette, Ind., May 17, 1898.

mental glow lamps), contributed in a more or less degree to the perfection of the incandescent lamp as now in every-day use; but so far as their contributing much that is substantial, in the development of a system of central-station distribution, it is probable that, up to the year 1880, there was but one man who realized that in solving the great problem of electrical distribution the perfection of a filament of high resistance, which, placed in a hermetically sealed glass globe from which the air had been exhausted and connected in multiple arc across an electric circuit, was the first necessity to the distribution of electric energy in our cities from a central-station system.

In Mr. Edison's application for a United States patent on a system of electrical distribution filed at Washington on February 5, 1880, he says:

The translating devices for each house may be either for light or power, or both. For light, the electric lamp, consisting of an incandescing material hermetically sealed in glass (shown in other applications made by me) is preferred. This lamp is made of a high resistance in comparison with that of any electric lamps which, to my knowledge, have been proposed. In lights heretofore proposed the endeavor seems to have been to lessen the resistance of the carbon, none having been suggested of higher resistance than, say, 10 ohms; but I have discovered that a very much higher resistance, say 100 ohms, must be used, in order that a number may be economically and successfully used in a system.

The question of the high resistance of the translating device was the first stepping-stone to success. Everybody prior to Edison had aimed at getting a low-resistance lamp, I presume on the theory that the less the resistance of one the less the resistance of the whole series. He struck out on new lines. A high-resistance lamp was naturally followed by a multiple-arc system.

In writing of the necessity of a high-resistance lamp, the applicant for the patent had in mind that a system of electrical distribution could be used at the same time not only for lighting but for power purposes, if the motors were properly constructed, and this is evidenced by the next paragraph in his application, which states:

The motors should be so constructed that each, with a constant flow or pressure of current, will give the exact power required. This requires that each motor should be wound with finer or coarser wire, and into more or less convolutions, which determine the maximum effect of the motor.

If you will search the files of the daily and technical journals and the proceedings of various scientific societies on both sides of the Atlantic from the summer of 1878 to and including the year 1882, you will find that the great obstacles in the way of an economical system of central-station distribution were the difficulties of producing a lamp that would last—one requiring only a minimum of current—and a system of electrical distribution requiring a minimum of capital, so as to enable electricity to compete with then existing methods of illumination and power. Professor Henry Morton, on December 28, 1879, says in the New York Times:

The first difficulty of all is the production of a lamp which shall be thoroughly reliable and neither complicated nor expensive. All attempts in the present lamp in this direction are acknowledged to be failures, and, as I have pointed out, there does

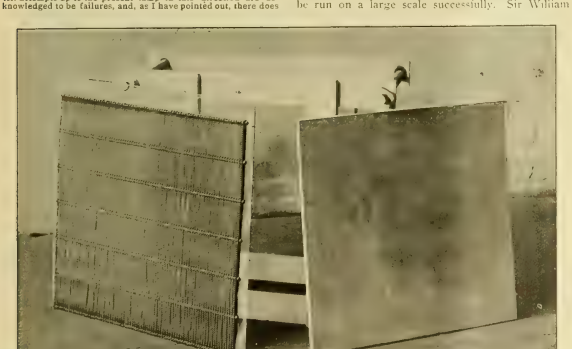

FIG 6 ELECTRICAL PRODUCTION OF OZONE.—FRAME, GLASS DIELECTRIC, SERRATED WIRE ELECTRODE AND FLAT ELECTRODE.

not seem to be any novelty such as would authorize us to hope for better success than the present one. The next difficulty is the economical production of small lights by electricity. This is what is commonly meant by the phrase "dividing the electric light." Up to the present time, and including Mr. Edison's latest experiments, it appears that this involves an immense loss of efficiency.

Next come the difficulty of distributing on any large scale the immense electric current which would be needed, and to provide for their equal action at different points under varying conditions of the number of lights used.

Again Mr. Conrad Cooke, giving evidence before the British parliamentary commisson in 1879, in answer to the question, "Supposing that the occupier of one house wished to put out his lights, how would this be effected?" replied:

In that case, if you throw out a lamp or throw out a house, you must throw into the circuit a resistance exactly equal to what you cut out. If you do not do that, you will affect every lamp in the series and the machine as well. If you put out your lights by breaking the circuit, you put out every light in the series.

In answer to another question at the same parliamentary inquiry, Mr. Cooke said (referring to Dr. Siemens, who had been named in the question):

His nephew told me himself that he had seen, I think, over 200 lamps on one of Edison's circuits.

And Mr. Cooke added:

I must say I should like to see it myself, and that is all I can say.

It is quite evident from this that Conrad Cooke, very well known in England as a prolific writer on the subject of electrical experiments, had in mind, in

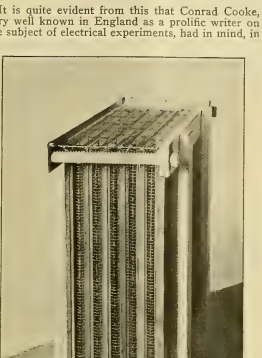

FIG 7. ELECTRICAL PRODUCTION OF OZONE.—GRIDS AND ELECTRODES MOUNTED IN FRAME.

1879, nothing better than the series system; that is, a number of incandescent lamps run precisely the same as arc lamps; or, to put it another way, his idea of the electric-lighting system was a varying potential and a constant current, which could never be run on a large scale successfully. Sir William Thomson (Lord Kelvin), referring to the same parliamentary inquiry of 1879, says:

I had not myself, at that time, any idea leading toward the practical realization of any such distribution of conductors and placing the lights as outlined in the Edison multiple arc and feeder system.

Evidently Mr. Swan, the English inventor, had no idea of the feeder system as late as October, 1880, as in a lecture before the Literary and Philosophical Society of Newcastle, England, at that time, he said:

The only way of avoiding this waste of energy, without abandoning the idea of small units of light, would be either to employ enormously thick conductors, or have every limited area supplied from one source.

Mr. Swan was referring to Mr. Edison's plain multiple-arc system, as set forth in his application of February, 1880. The last eight words of this quotation prove that Mr. Swan did not then know of Mr. Edison's feeder system, application for patent on which was made on the 9th of August, 1880, and was patented in England on the 24th of September of the same year. It would seem that even in 1882 Mr. Swan, who himself at that time must have been informed as to Mr. Edison's invention of the feeder system, could not have appreciated the possibilities of such a system, as, in a paper communicated to the British Association at Southampton in August of that year, he stated:

The only escape from that limitation (extent of distribution) lay in having secondary batteries at stations or in houses, and in these batteries being charged in series, and fed by currents of higher tension, the principle still holding of multiple arc, not from the central station, but from the subsidiary ones from which the batteries are charged. Once imagine the possibility of these secondary batteries being kept at a perfectly constant condition of charge by some automatic arrangement, and we might look to that as a means of escaping from the difficulties of wide distribution.

Again we find that Dr. C. W. Siemens, before the Society of Arts in London, on the 15th of November, 1882, said that he thought

It would be possible to establish electrical mains in the shape of copper rods of great thickness, with branches leading from them in all directions, though he was himself decidedly averse to such a plan. He said he would limit the area of the densely populated district to one quarter of a square mile, notwithstanding other individuals of high standing in electrical circles held that areas of from one to four square miles could be worked to advantage.

Dr. Siemens went on to say:

In considering the proper size of conductors, two principal factors have to be taken into account: First, the charge for interest and depreciation on the original cost of a unit length of the conductor, and secondly, the cost of the electrical energy lost through the resistance of a unit of length. The sum of these two, which may be regarded as the cost of the conveyance of electricity, is clearly least, as Sir William Thomson pointed out some time ago, when the two components are equal. This, then, is the principle on which the size of a conductor should be determined.

Lord Kelvin, commenting on Dr. Siemens' remarks of November 15, 1882, before a commission taking evidence with relation to the Edison feeder patent, said:

There is not a word here of the necessity to secure against too great drop of electric potential between the dynamo and the lamps, or too great differences of drop between the different lamps of the system, and the narrow limitation of the area insisted upon shows that Dr. Siemens had no idea of Edison's solution of the problem, and thought only of overcoming the difficulty by enormously massive copper conductors with branches diverging from them to the points of consumption. From his earliest commencement as an inventor and engineer, Siemens had been occupied with water and gas. His first invention was a water-meter, and it is not probable that anyone in the years 1879-80 knew better than he did of the difficulties met with in the distribution of water and gas, and of the methods which had been practically used or proposed for overcoming them.

Again referring to this same subject, Sir William Thomson said:

About that time, or a little later, one of our first electrical engineers, Mr. Crompton, who has, in fact, more than any one to introduce successfully and on a large scale lighting from a central station in London, found that he was obliged to use larger copper conductors than would be required merely in accordance with my principle for economy, in order to avoid so great a drop in potential as would be inconsistent with the good working of the lamps. At that time he had no idea of the feeder system, which he has since adopted with marked success in the Kensington-Knightsbridge electric lighting. Siemens' solution was not augmenting the size of the conductors above that calculated from the economic law, but to limit the size of the station supplied. Neither this nor the solution first proposed by Crompton is satisfactory in respect to the practical demands for the electric lighting of towns. Edison's feeder system is now universally admitted to be satisfactory to a very remarkable degree. I am asked why did not some one else invent it. The only answer to to this, the last part of the question, that I can think of, is that no one else was Edison.

I personally well remember Sir William Thomson's visit to the Pearl street station in New York, in 1884, when he saw the Edison feeder system first in operation, and the great interest that he exhibited in studying it, and his admiration for the work accomplished by Mr. Edison in this connection.

I have thought it necessary to thus quote at length some of the leading English authorities on electrical matters, as I thought it would be better, in claiming for an American the conception of the true basis of electrical distribution for light and power purposes, to give you the opinion and views on the matter of distribution of our "kith beyond the sea" rather than to quote the views of American scientists, who might possibly be considered more partial to the work of their own countryman.

It is often said that the principles of constant-potential multiple-arc distribution and the use of feeders to maintain an equal and economical distribution of pressure are self-evident propositions, following the lines of gas and water distribution; but when you have such high authorities as Conrad Cooke in 1879 failing to recognize any of these necessities, of Mr. Swan in 1880 only recognizing the principles of multiple arc, and in 1882 failing to recognize the importance and far reaching results of the feeder system, and Dr. Siemens as late as November, 1882, two months after a central station was in operation in New York city, adopting almost the same views as Mr. Swan, you cannot wonder at Lord Kelvin answering the question as to why someone else did not invent the feeder system by saying: "The only answer to this, that I can think of, is that no one else was Edison."

It would seem to me, with such authorities, that it is not unreasonable to claim that the development of the central station and distribution system connected therewith dates from Mr. Edison's work at Menlo Park. Mr. Edison had been engaged during the early 70's, first as a telegraph operator in the Western Union service, and later working on the gold indicators in the gold room in New street, New York, during the stirring period of speculation in

the precious metal which culminated on Black Friday in 1873. Professor C. C. Law, now connected with the University of Missouri, had, I believe, charge of the indicating instruments, and it is a matter of some interest to record the fact that the first work Mr. Edison did of an inventive character which yielded him a financial return was in connection with and while he was at work on the gold indicators in question. Subsequently he was employed in the interest of what is now the Western Union Telegraph company, in improving the now universally-used stock ticker. This work was followed by brilliant and successful work in connection with the duplex and quadruplex and automatic systems of telegraphy, and the invention of the phonograph and that part of the telephone now generally used for transmitting purposes, and known as the carbon transmitter. His attention to the possibilities of what is popularly called the subdivision of the electric light was probably the result of a visit he paid to Mr. William Wallace at Ansonia in the fall of 1878, where he saw some experiments on a dynamo machines, and on his return to Menlo Park he started his experiments on a system of electric light and power, which culminated in the successful starting of the first central station, in the lower portion of New York city in September, 1882.

The public interest aroused in his work and the controversy as to whether it was possible for him to achieve anything that would be of commercial value are evidenced by the constant reference to the matter in the public press in 1878, 1879 and 1880, resulting in a panic in gas securities in London in 1878 and in New York in 1879. Probably the work of no inventor was more generally discussed on both sides of the Atlantic by laymen and technical authorities alike than was that of Mr. Edison on his electric-lighting and power system. All kinds of comparisons were made as to the difference between the cost of gas and the cost of electricity. It was claimed by many that Mr. Edison could not possibly be considered as having succeeded in his work unless he could produce an illuminant that would compete commercially with gas. They lost sight of the fact that the characters of the two illuminants were entirely different, and that there was no more reason for supposing that, if electricity were more expensive than gas, the cost would be a barrier to its use, any more than there is reason for supposing that gas should be considered a commercial failure because the poorest classes find it cheaper to use tallow dips. The probable reason for scientists and electricians doubting the possibility of a successful electric-lighting system being produced was that all previous experimenting on incandescent lamps had been, as I have already stated, aiming at producing a lamp of the lowest possible resistance, and consequently requiring the greatest possible amount of current, these lamps being run in series, whereas Mr. Edison, at a comparatively early stage of his work, realized that the first essential was a lamp of high resistance, and that the only way of approximating an even distribution of pressure was to run these lamps in multiple arc. Hence his application for a patent on a lamp with a high-resistance filament, under date of November 4, 1879, and his application on multiple-arc distribution in February, 1880. It was then but a short time before he realized that, although experimentally by this might give him even pressure, the expense of the copper in his distribution system would be too great, owing to the necessity of increasing the size of his copper as he got farther and farther from the point of generation. The result was that in March, 1880, he applied for his patent on a system of feeders to supply his system of mains at various points throughout the system, the effect being a compact system with current flowing in all directions from the central point of generation through feeders, by means of which even pressure could be maintained throughout a considerable area.

A still further step made by Mr. Edison was the realization that nothing very reliable in the way of a distribution system in large cities could be maintained unless the work was placed underground, and, as a result of his work of a little over two years, we find that, in the early winter of 1880, Edison had a central-station system experimentally at work at Menlo Park, N. J., having an underground two-wire system, with the homes of himself and his staff electrically illumined by incandescent lamps, motors at work in his laboratory, and, in fact, all of the essential features of what is to-day now so common from the largest cities to the smallest villages throughout the whole civilized world.

It was but a short time after the starting of the first central station, in New York that Mr. Edison found himself looking for some more economical methods of distribution; and I well remember his first experiments on the three-wire system, when, at his shop in Goerck street, New York, he placed a third brush on the neutral point of the commutator of a small bi-polar Edison dynamo and demonstrated the practicability of the three-wire system.

At the same time that Edison was working on the three-wire system experimentally in New York, Dr. John Hopkinson was probably figuring out the same thing in England, and Werner von Siemens was engaged in similar work in Germany. The records of the United States, English and German patent offices bear witness to the fact that these three men accomplished about the same results at about the same time, and, as a consequence, between 60 and 70 per cent. of the investment in copper was saved.

It is not my wish to address you on the scientific or technical side of central-station development. I have thought it necessary to go at length into the early work of the art more for the purpose of giving you some idea of the position to which Mr. Edison is entitled as the father of central-station work. My limited knowledge of the technique of the business would not permit me, even if I wished, to discuss the details of his early work, or of the early work of other experimenters; but I assure you that daily familiarity with the operation of one of the largest central stations in this country gives me a higher and higher appreciation of the simplicity and thoroughness and adaptability to all purposes of electrical distribution of the great work accomplished by the "Wizard of Menlo Park."

As a result of the experiments at Menlo Park, Mr. Edison, early in the winter of 1880, started to get together the necessary data for the establishment of a central-station and distributing system in New York, in the district bounded by Wall street on the south, Nassau street on the west, Peck's slip on the north, and South street on the east, a territory covering about 2,000 feet square. He had each house thoroughly canvassed to show the number of lights in use, the number of hoistways and elevators, and the horse power of the engines running machinery. You will find on the walls around us the blueprints of these original canvasses.[1] On one blueprint you will find an enumeration of the power in use in that district and on the other blue-print a record of the lights there used. As a result of this

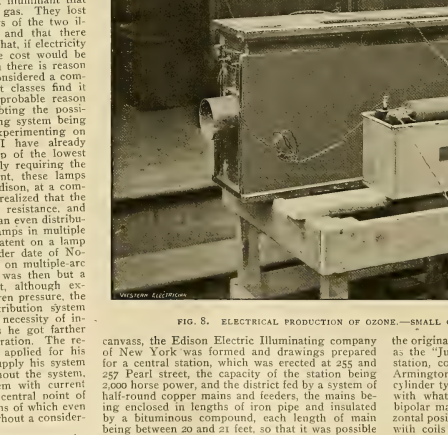

FIG. 8. ELECTRICAL PRODUCTION OF OZONE.—SMALL OZONIZER AND TRANSFORMER.

canvass, the Edison Electric Illuminating company of New York was formed and drawings prepared for a central station, which was erected at 255 and 257 Pearl street, the capacity of the station being 2,000 horse power, and the district fed by a system of half-round copper mains and feeders, the mains being enclosed in lengths of iron pipe and insulated by a bituminous compound, each length of main being between 20 and 21 feet, so that it was possible to take off a service at each house.

Time will not permit me to go into the details of construction of this, the first central distribution system. You will see by referring to the outline drawings of the station which I have with me, that the boilers were placed down below and were of the horizontal water-tube type, made by Babcock & Wilcox, carrying a pressure of 125 pounds, the steam machinery and dynamos being of the direct-connected type and placed on a steel structure not dissimilar to that of some portions of the elevated-railroad structure in New York.

Great care was taken in figuring out the system of mains and feeders, an immense plot of the district being represented by a series of resistances, showing in miniature the probable consumption of current in the various parts of the district. It should be remembered that the path to be followed was practically unknown, that electrical distribution on a large scale was as much of a hidden secret as an unexplored continent, and the remarkable thing is that this first experimental system was a practical success, and a return on the money invested was being earned before electricians at home and abroad would recognize the success of the undertaking. It is but natural that many devices were used which were subsequently absolutely discarded. For instance, an elaborate system of resistances placed in series with the feeders was employed for maintaining an even pressure, entailing a considerable waste of energy. The lamp employed was not more than one-half as efficient as that used to-day, while the cost of manufacture was many times greater, and it had not one-quarter of the life of the present commercial incandescent lamp.

It might be well to pause for a moment and picture the condition of the art at that time. I refer to the winter of 1880. The plans for the central station were completed; the details of construction of the conductors in the street were all on paper; the dynamos and electrical instruments had no existence except on the draughting-board; practically nothing was known of modern methods of insulation or house wiring; the socket and switch in use to-day had not been thought of; the miscellaneous devices now considered necessary in connection with house-wiring had not been considered. In addition to the development of the system and its installation, manufacturing establishments had to be created in which to manufacture the first material needed, and Mr. Edison and his corps of assistants had to abandon the experiments of the laboratory and the designing of the draughting-room to equip and manage shops in which to manufacture the apparatus necessary, from the generator to the lamp. Others have followed the beaten track, others have improved upon the methods employed, but the conception of the system, the perfecting of the original apparatus, its manufacture, its installation and its early operation were all borne by an enthusiastic but small band of workers having an almost idolatrous belief in their chief as the pioneer of this great industry.

I have brought with me to-night a photograph of the original direct-connected steam generator, known as the "Jumbo" machine, used in the Pearl street station, composed of an engine manufactured by Armington & Sims of Providence, R. I., of the single cylinder type, running at a speed of 350 revolutions, with what is practically the old form of Edison bipolar machine changed from a vertical to a horizontal position, the armature, instead of being wound with coils of wire, being built up of copper disks and bars. If you will glance from this to the picture of a modern central-station unit composed of a compound, triple or quadruple expansion engine, with a multipolar dynamo connected directly on the engine shaft, you will find that the same broad engineering idea is alike apparent in the earliest and latest central-station unit. The improvements in dynamo manufacture have enabled us to use lower-speed engines, but the broad principle of direct connection is alike the same in both. That we should come back to exactly what Mr. Edison used in the earliest central-station work is no mean tribute to him as an engineering authority.

The delay which necessarily occurs in carrying every new enterprise to a financial success acted as a wet blanket on central-station development. Efforts were made to cheapen construction when it was found that capitalists in large cities were unprepared to risk their money in the enterprise. The apparatus was adapted to the requirements of smaller communities, and, as a result, a number of small stations were established throughout the country, especially in Pennsylvania, Ohio and Massachusetts. The development of the central-station business for several years was confined to this class of work. The service was far from reliable, owing mainly to the necessity of doing the cheapest possible engineering and construction in order to meet the necessities of the slim exchequers of those who were bold enough to embark their capital in this business; but the Pearl street station, started on September 5, 1882,

[1] The curves and charts are not reproduced here as they form part of the confidential records of the Chicago Edison company.

with 5,500 lamps, rapidly developed, and in the fourteenth month of continuous running had 508 customers wired for 12,732 lamps. Comparatively little work was done in central-station lighting in Europe. A small station was started in Dijon, France, in June, 1883, and in the same year an installation was made in Santiago, Chile; in Milan, Italy; on Holborn viaduct, London, and in Manchester.

The success of the Pearl street station resulted in the extension of the New York system and the building of two stations uptown in New York, one in Twenty-sixth street and the other in Thirty-ninth street. This was followed by a station in Boston and another in Brooklyn. In 1887 the building of the first station in Chicago was started, the average load, as shown by the composite ampere curves of that station, which I have with me, being not much over 500 amperes for the year 1888. These latter stations, the two in New York, the one in Boston and the one in Chicago, were equipped with high-speed engines belted to Edison bipolar dynamos of the Siemens armature type, in some cases the engines and dynamos being on the same

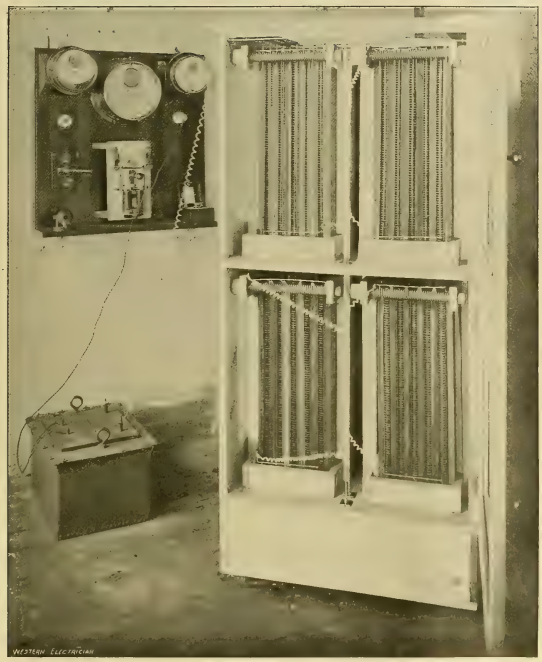

FIG. 9. ELECTRICAL PRODUCTION OF OZONE.—LARGE OZONIZER IN BOX.

floor, in other cases the engines being belted to the dynamos on the floor above. Numerous other stations were started, so that by 1890 upwards of 60 cities were equipped with the direct-current low-tension system, all of which, and numerous others, are to-day so remunerative that their securities are considered among the most desirable local investments, especially in cities of the first and second rank.

The success of the low-tension system was followed by the introduction of the alternating system, using high-potential primaries, with the converters at each house, reducing, as a rule, from 1,000 down to either 50 or 100 volts. I am not familiar with the early alternating work, and had not at my disposal sufficient time in preparing my notes to go at any length into an investigation of this branch of the subject; nor do I think that any particular advantage could have been served by my doing so, as it has become generally recognized that the early alternating work with a house-to-house converter system, while it undoubtedly helped central-station development at the time, proved very uneconomical in operation and expensive in investment, when the cost of converters is added to the cost of distribution. The large alternating stations in this country have so clearly demonstrated this that their responsible managers have, within the last few years, done everything possible, by the adoption of block converters and three-wire secondary circuits, to bring their systems as close as they could in practice to the low-tension direct-current distribution system. I do not want to be understood as undervaluing the position of the alternating current in central-station work. It has its place, but to my mind its position is a false one when it is used for house-to-house distribution with converters for each customer. The success of the oldest stations in this country, and the demonstration of the possibilities of covering areas of several miles in extent by the use of the three-wire system, resulted in much capital going into the business. One of the earliest stations of a really modern type installed on either side of the Atlantic was built by the Berlin Electricity Works. The engineers of that station, while recognizing the high value of the distributing system, went back to Edison's original scheme of a compact direct-connected steam and electric generator, but with dynamos of the multipolar type designed and built by Siemens & Halske of Berlin, the engines being of vertical marine type.

This was followed by the projecting in New York of the present Duane street station, employing boilers of 200 pounds pressure, triple and quadruple-expansion engines of the marine type, and direct-connected multipolar dynamos. Almost immediately thereafter, the station in Atlantic avenue, Boston, somewhat on the same general design, so far as contents are concerned, was erected. In 1891 a small station, but on the same lines, was projected for San Francisco, and in 1892 the present Harrison street station of the Chicago Edison company was designed, and, benefiting by the experience of Berlin, New York and Boston, this station produces electric current for lighting purposes probably cheaper than any station of a similar size anywhere in this country.

It is not necessary for me to go into detail in explanation of the modern central station. You are all doubtless quite familiar with the general design, but if you will examine the detail drawings of the Harrison street station, which I have brought with me, you will find that every effort has been made

[*Continued on page 316.*]

Purification and Sterilization of Wat by Ozone.

In 1894 the Municipal Council of Paris offered a prize for the best process for purifying and sterilizing the water of the river Seine. No less than 148 methods were presented, no one of which was accepted as satisfactory. The various processes included thermic, chemical and mechanical suggestions. Filtration through sand, charcoal, cellulose, asbestos and kaolin, and chemical treatment with lime, salts of iron, aluminum, etc., were proposed. An electro-chemical method promises, however, to solve the vexed question in an economical and perfect manner.

Experiments have shown that ozone has a marked destructive power over microscopic organisms in water, provided the water is not too largely filled with organic substances.

Baron Tindal of Oudshoorn (Holland) has experimented extensively upon this matter since 1891. The results have been so satisfactory that they have led to the erection of a large installation at Saint Maur, which daily treats 20,000 cubic meters of the Seine water, at a minimum cost of 0.025 of a franc for each cubic meter.

At the Brussels Exposition an exhibit was made of the system, which included an alternate-current dynamo which was made to produce a current of 30 amperes at 75 volts. This current was raised by a step-up transformer to 35,000 volts, one terminal of the circuit being grounded, the other leading to the ozonizers. A second transformer here raised the electromotive force to 100,000 volts. Insulation was now difficult of maintenance. For this purpose the secondary circuit comprises 10 bobbins in series of 10,000 volts each, supported by glass and wood, and separated 10 centimeters apart. There is an

Fig. 1.

Fig. 2.

Fig. 3.

PURIFICATION AND STERILIZATION OF WATER BY OZONE.

air space of 20 centimeters between the secondary and the primary, the latter being within the former. The magnetic circuit, composed of a bundle of soft iron plates, is also carefully separated from the rest of the apparatus.

The chambers for ozonization are in the form of a rectangular frame 25 centimeters wide, 35 centimeters high by 60 long. Their purpose is to provide a resistance sufficiently high to prevent sparking and insure a silent discharge. Each tube ends in the interior of this case or chamber at a metal block composed of several leaves of platinum bound together (Fig. 1), which forms one electrode. The other electrode consists of a couple of gilded copper plates (Fig. 2) lying against the side of the case, and thence connected to earth.

When the current passes between the interior plates of this case it appears as a violet band, with rays slightly divergent and of a deeper color. Fig. 3 represents the five chambers.

The air to be treated is drawn by a pump through a dry cotton-batting filter to cleanse it of dust, then through calcium chloride to desiccate it, then further manipulated with sulphuric acid. From here it passes into the first ozonizer through openings in one of its sides, thence into the second and on through the series of five chambers.

As it is very essential that the air be kept cool as well as dry, a coil is placed between each two cases, through which a current of air is constantly circulating at a temperature reduced to —25° Centigrade by means of an ammonia machine. The air is thus cooled in its passage from one case to the next.

Leaving the last ozonizer, the air enters the sterilizing columns, which are of stone or enameled iron, provided with false bottoms pierced with holes, by which the ozonized air is ejected in the form of bubbles, and is also washed by ascending spray.

A second system consists in converting the water into cold vapor in the ozone chamber. This process does not require so high a pressure as the former, and as it costs less to work at a lower pressure, there is probably a point where economy would be greatest between two extremes. L'Electricien is the authority for the facts in this brief article.

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Everything is now in readiness for the reception of members of the National Electric Light association, the committee representing the Chicago electrical interests having completed its preparations for the convention which is to assemble in this city on June 7th.

It is expected that this gathering will include more central-station managers and more practical electrical engineers than have ever before attended a meeting of that body. The convention will be devoted to the discussion of topics and reading of papers upon subjects of vital importance to the industry, and it is believed that the programme as already outlined in the Western Electrician will attract many practical men who will be anxious to participate in the discussion. The arrangements for the entertainment of the visitors have been made with the view of allowing the members to attend each meeting of the association. In order that there might not be any inducement to members to remain away from the meetings, everything that would conflict with the order of business was eliminated. The ladies who will accompany the visiting members will be cared for during the day, and a special programme has been arranged for their benefit.

The tendency in the National Electric Light association is toward a strong, conservative and progressive organization that will exert a powerful influence, especially as an educational factor, in the community. The present administration is in hearty sympathy with this spirit, and the Chicago meeting will, it is hoped, serve as an example for future gatherings of the organization.

The announcement of the managers of the excursion-convention under the auspices of the Northwestern Electrical association proclaims the assurance of success, and all friends of the organization will welcome this cheering message. The novelty of the scheme is itself an attractive feature and should prove a drawing card, but there are other considerations which should insure a good attendance.

In many ways Mr. Insull's lecture at Purdue University on the "Development of the Central Station" is an exceedingly interesting and valuable contribution, and, as an historical document, it will doubtless be accepted generally as an authoritative statement of the claims of that "enthusiastic but small band of workers" mentioned in the address as "having an almost idolatrous belief in their chief as the pioneer of this great industry." It must be conceded, too, even by those who do not share the enthusiastic devotion that inspired this document throughout, that as Edison's historian Mr. Insull has very skillfully presented his claims, relying for evidence with which to support them almost entirely upon unfriendly witnesses. Mr. Insull's close association with Mr. Edison while the experimental work was being conducted, and the first central station at Pearl street, New York, was being built and equipped, afforded him exceptional facilities for gaining information bearing upon that important period and an opportunity to study the character of the directing genius in all these undertakings. It is not to be wondered, then, that a sketch of this kind by one so intimately identified with Mr. Edison should take on the character of a personal tribute. With these facts in mind we commend a careful perusal of Mr. Insull's lecture to all who are interested in the historical side of the electrical development of this country. The period covered in this address was probably the most interesting and undoubtedly the most important in the electric-lighting industry.

The wisdom of employing a competent attorney to prepare and present applications for patents should be universally recognized, yet there are many inventors who consider themselves the best advocates of their claims. It is evident that the new commissioner of patents intends to discourage the personal solicitation of patents by inventors who are not familiar with the requirements of the office. He has issued a circular calling attention to one feature, which, although comparatively unimportant, is nevertheless of enough moment to command consideration. The circular calls attention to order 789, dated November 26, 1892, which is as follows:

It is hereby directed that in the printing of claims of applications for patents the punctuation of the claims as made by applicants be strictly followed and that the punctuation of the specification made by applicants be not departed from except to cure a manifest absurdity.

This order is still in force, and the commissioner says: "Examiners are prohibited from making any change in the claims or specification of an application without the consent of applicants or their attorneys; but when amendment becomes necessary the office will duly advise, by letter, the applicant or his representative before passing a case to issue."

It might be added that this regulation applies with equal force to a certain class of solicitors, who have neither special knowledge nor experience and are not particularly well fitted for this class of work.

It has been proposed to utilize Röntgen rays in the hospitals of the American navy and army during the war with Spain, and it is encouraging to learn that their use in the Indian campaign saved life and useless mutilation. The London correspondent of the Sun says that the first reports of the use of the Röntgen rays in warfare was made on May 20th at the United Service Institution by Surgeon Beevor, who described the results of their use in the recent frontier campaign in India, and gave lantern views. Many important cases consisted of bullet wounds received by officers and men who were injured in bones, joints and internal organs. Their injuries, but for the X-rays, would have resulted in the amputation of limbs and probable loss of life. The pictures shown included wounds in the arm, leg, chest, back, finger and other parts. In every case the bullets were located by the use of the X-rays and successfully removed, the men subsequently rejoining their comrades at the front. The portable apparatus weighs 80 to 100 pounds. The subject is receiving attention at the hands of the army and navy surgeons, and similar devices will doubtless be adopted in the American service.

The right of a city council to grant an exclusive franchise to a street-railway company to occupy a public thoroughfare is denied by the Supreme Court of the United States. The question was raised in the case of the Detroit Citizens' Street Railway company against the Detroit Railway company and the city of Detroit, and the decision was handed down by Justice McKenna sustaining the ruling of the state courts of Michigan, from which appeal had been taken. In 1862 an ordinance was passed by the Detroit City Council giving to the Detroit City Railway company, of which the Detroit Citizens' company is the successor, the right to lay railways in streets voted by the council, to the exclusion of all other companies. In 1879 this right was extended for 30 years. In 1894 the council passed an ordinance giving the Detroit Railway company the right to lay tracks on the same streets already occupied by the lines of the old company. The latter brought suit at once to restrain the new organization, on the ground that the ordinance impaired the validity of its contract with the city. The decision is based upon the fact that public thoroughfares cannot be disposed of in the same manner as private property.

Those who favor the policy of municipalities assuming control of street-railway properties upon the expiration of the original franchises, or at any time designated in the ordinance granting the privileges, will be interested in the decision of the Court of Appeals denying the obligation of the Eighth Avenue Railroad company to surrender its railroad to the city of New York upon receiving in payment therefor an amount equal to the cost of the line and 10 per cent. additional. The grant to construct the road was made in 1851 to John Pettigrew and his associates by the Common Council, whose resolution required the grantees to stipulate to transfer the road to the city whenever required so to do upon payment of its cost and 10 per cent. thereon. The Court of Appeals declares this resolution to have been wholly void, because the Common Council thereby undertook to authorize the laying of railroad tracks in the city streets and avenues, a power which belonged not to that body, but to the Legislature. The contract made by Pettigrew and his associates in accordance with the terms of this void resolution is also held to have been void. In 1854, however, the Legislature passed an act relative to the construction of railroads in cities, which authorized those who had already commenced the building of such roads under municipal grants to complete them. This confirmed the rights of Pettigrew and his associates, which were subsequently acquired by the Eighth Avenue Railroad company. The decision will prove valuable to that corporation and to the Metropolitan Street Railway company, which has allied interests, and possibly to other companies operating under similar conditions.

WAR NEWS.

Chicago Edison Volunteers for Naval Service.—The group of portraits on this page depicts the features of former employes of the Chicago Edison company who tendered their services to the government on the first call for naval recruits and left Chicago on last Tuesday to join the squadron under Admiral Sampson. They are evidently well fitted for service, having passed very creditable examinations.

S. H. McEwen. J. Goldsmith.
W. B. Tullock. B. R. T. Collins. A. Montgomery.
T. Roberts.

CHICAGO EDISON VOLUNTEERS FOR NAVAL SERVICE.

B. R. T. Collins, who is the central figure in the group, was one of the most popular members of the engineering staff of the Chicago Edison company. He was graduated by the Massachusetts Institute of Technology in 1888, and for four years acted as instructor in that institution. He joined Sargent & Lundy during the construction of the Harrison street station of the Chicago Edison company, and upon the completion of that plant was induced to accept a position as assistant to the chief engineer, and conduct a series of exhaustive tests at the Harrison street power house, which have been carried to a point of completeness never before attempted in central-station practice. Mr. Collins was an active member of the Northwestern Alumni association of the Massachusetts Institute of Technology, and has occupied the office of president of that organization. He has kept abreast of the times, and attained an excellent reputation in engineering circles. He has always shown deep interest in naval affairs, and upon the organization of the naval reserves in this city, took an active part in the association. When the call for volunteers for the naval service was issued, Mr. Collins took the examinations prescribed by the government, together with 15 associate officers. He was eleventh in rank among the competitors, but stood third in the examination, and was appointed junior lieutenant. This excellent showing was particularly gratifying to Mr. Collins' friends, as several of the men who competed for honors were graduates of the naval academy at Annapolis.

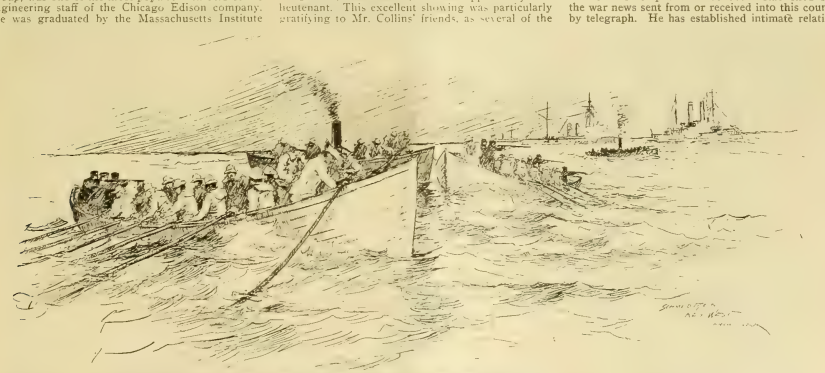
The young men who accompany Mr. Collins were engaged in the Harrison and Washington street power plants of the Chicago Edison company. They all stood high in the examination for engineers, and expect to get good berths in consequence. They are S. H. McEwen, J. Goldsmith, W. B. Tullock, A. Montgomery and T. Roberts.

Cable Cutting at Cienfuegos.—Details of the tempt to cut the cables on the southern coast of Cuba by crews of the United States cruisers Nashville and Marblehead were presented in the Western Electrician last week. The picture on this page, which is reproduced through courtesy of the Chicago Record, shows the boats from the Nashville and Marblehead engaged in cutting the cables at Cienfuegos, under fire from the shore batteries. The picture was drawn by Schmedtgen, the Record's staff artist at the Key West rendezvous, from a sketch made by an officer on the Marblehead. The task of cutting the cables proved a very perilous undertaking, as the men were obliged to work in open boats, with no protection whatever from the fire of the enemy. According to the official report the men performed their work with the utmost coolness and intrepidity. The fire from the Maxim guns on shore and the infantry became too hot, however, and the crews were withdrawn, after sustaining a loss of two men killed and seven wounded. Two of the cables were cut at that time, and since then, it is said, the third was also found and severed.

GEN. A. W. GREELY.

General A. W. Greely.—The chief signal officer of the United States army, General Adolphus W. Greely, is one of the best known officers in the service, both at home and abroad. His expedition to the Arctic region gave him an international reputation and secured for him many honors from foreign scientific societies as well as promotion at home. The present war makes General Greely's position one of great importance. He has charge of the censorship which has been established over the war news sent from or received into this country by telegraph. He has established intimate relations with all the telegraph and cable companies to that end, and messages or parts of messages which are thought to be harmful to the interests of the government are not transmitted. The decision as to what is permissible is made by a number of censors, who are army officers, stationed at important points. In addition, the companies refuse to forward messages in secret or ambiguous language and generally co-operate with the authorities. The restric-

[Continued on page 316.]



CABLE CUTTING AT CIENFUEGOS.—BOATS FROM THE NASHVILLE AND MARBLEHEAD UNDER FIRE FROM SHORE BATTERIES.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

(From the Minneapolis correspondent of the Western Electrician.)

The old officers and directors of the La Crosse (Wis.) Telephone company were all re-elected at the annual meeting.

The Central Telephone company has ordered material for an exchange to be established at Rockwell City, Ia.

The Iowa Telephone company is an applicant for a franchise into Primghar, Ia.

The Billings and Fergus County Telephone company has been incorporated to build a telephone line from Billings, Mont., to Lavina and later to Lewistown.

A telephone line has been completed between Butte, Mont., and Twin Bridges.

The Mount Ayr, Ia., telephone exchange is now a night office.

Agnes Hammontree, an employe of the Iowa Telephone company at Des Moines, sustained a severe accident while riding a bicycle. In a collision she was thrown to the pavement, striking on the back of her head and injuring the skull, it is feared, dangerously.

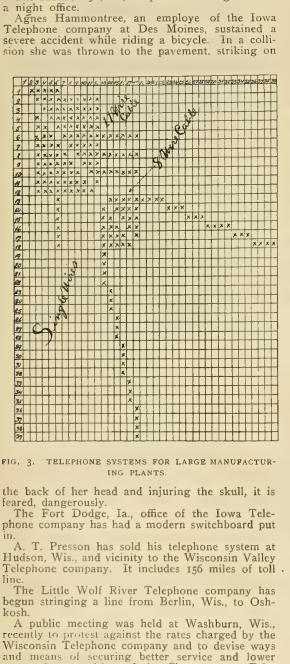


FIG. 3. TELEPHONE SYSTEMS FOR LARGE MANUFACTURING PLANTS.

The Fort Dodge, Ia., office of the Iowa Telephone company has had a modern switchboard put in.

A. T. Presson has sold his telephone system at Hudson, Wis., and vicinity to the Wisconsin Valley Telephone company. It includes 156 miles of toll line.

The Little Wolf River Telephone company has begun stringing a line from Berlin, Wis., to Oshkosh.

A public meeting was held at Washburn, Wis., recently to protest against the rates charged by the Wisconsin Telephone company and to devise ways and means of securing better service and lower rates. A proposition of the Chequamagon Telephone company to put in an exchange at a 25 per cent. reduction from present rates was accepted, and the system will be installed at once.

The Northwestern Telephone company has begun constructing a line between Elma and Charles City, Ia., and it will probably be continued to Cresco.

The Sioux Valley Electric and Telephone company has been incorporated at Arlington, S. D., with $50,000 capital stock.

The Minnesota Central Telephone company has about completed arrangements to establish an exchange for St. Cloud, Minn.

The Fergus Telephone company of Fergus Falls, Minn., has let the contract to Jones & Winter of St. Paul to install a telephone exchange. It is to be completed by July 31st.

The capital stock of the Mankato Citizens' Telephone company has been all paid up and 175 instruments taken on a five-year contract. Application will be made at once for a franchise to the council.

Manager Robinson has completed a telephone exchange at St. James, Minn., with about 60 instruments in use at the start.

The Marquette County Telephone company has been compelled to add another section to its switchboard at Ishpeming, Mich.

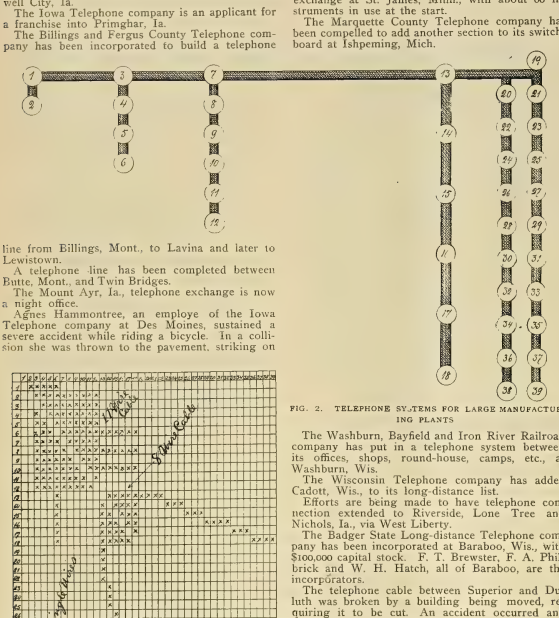


FIG. 2. TELEPHONE SYSTEMS FOR LARGE MANUFACTURING PLANTS

The Washburn, Bayfield and Iron River Railroad company has put in a telephone system between its offices, shops, round-house, camps, etc., at Washburn, Wis.

The Wisconsin Telephone company has added Cadott, Wis., to its long-distance list.

Efforts are being made to have telephone connection extended to Riverside, Lone Tree and Nichols, Ia., via West Liberty.

The Badger State Long-distance Telephone company has been incorporated at Baraboo, Wis., with $100,000 capital stock. F. T. Brewster, F. A. Philbrick and W. H. Hatch, all of Baraboo, are the incorporators.

The telephone cable between Superior and Duluth was broken by a building being moved, requiring it to be cut. An accident occurred and delayed the uniting of the break for some hours.

The Assembly of St. Paul has passed a franchise for the American Telephone and Telegraph company for a long-distance service in accordance with the company's request, but it stipulates that, in the event of the company establishing a local system, it shall not charge more than the lowest charge of any existing company, and gives the council authority to fix maximum rates.

1 President
2 General Manager
3 Vice President
4 Treasurer
5 Secretary
6 General Superintendent
7 Chief Book-keeper
8 Purchasing Agt.
9 Sales Dept.
10 Shipping Dept.
11 Advertising
12 Correspondence

The Luverne Telephone company will be formed at Luverne, Minn., to put in an exchange. Contracts have been closed for 65 instruments and a 100-drop switchboard has been ordered.

It is rumored the Iowa Telephone company will build through Adrian, Minn., this season.

Municipal Telephone Exchanges.

The great demand in England for municipal telephone exchanges may perhaps induce the government to grant licenses, says the London Electrical Engineer. At any rate the corporation must remember that the exchanges, if started, must be better and have more subscribers than those they compete with.

The postmaster-general has notified the highways committee of the London County Council, in reply to an application by that body for a license empowering the council to provide an independent municipal telephone service in London, that he feels it incumbent upon him to await the report of the select committee appointed by Parliament.

Telephone Systems for Large Manufacturing Plants.

By H. P. Clausen.

Since the advent of the telephone manufacturers independent of the American Bell Telephone company, thousands of telephone instruments have been sold to individual users, and, though widely differing opinions prevail regarding the probable total number of telephones already produced by the independent manufacturers, it may safely be assumed that at the present time the grand total is growing at the rate of at least 500 instruments per day.

In its simplest form the telephonic circuit consists of two telephones placed at the extremities of a connecting wire, and whenever telephone A desires to communicate with telephone B, the mere act of pressing a button, turning a crank or, more convenient still, removing the telephone receiver from its support, may be the means of calling the distant correspondent. As a matter of fact, such is indeed the ideal conception of a perfect telephone system—an unattainable condition, however, and we are therefore obliged to depend on some kind of a time-consuming means for interconnecting the circuits of three or more distinctly separate telephone systems.

We are all familiar with the service rendered by the average telephone companies, and that knowledge, in a way, is acting as a sort of a damper on the enthusiasm of managers for large manufacturing concerns, for whenever the question arises as to whether it would be advisable to install a local telephone system, the manager generally feels loath to add to his establishment that which appears to be a lot of complicated apparatus; but after once experiencing the immense savings of time that may be effected with a well-designed system properly installed, the wise manager never fails to speak a good word in favor of factory telephones.

Realizing the futility of attempting to give a general description of all systems designed especially for use in factories, etc., the writer will confine himself to the description of a most simple manually operated system, wherein all calling signals are transmitted by the caller direct; that is to say, he is able to create at will a temporary connection with the signal-receiving circuit of the desired correspondent. When it is necessary, however, to give service to a comparatively large number of stations operated on the plan mentioned, say over 20, the number of interconnecting wires that are required becomes rather large. Moreover, when it is considered that each wire belonging to a given telephone must be connected to every switching station of the system, it becomes quite plain why such systems are rarely employed in plants consisting of more than 20 stations.

Referring to Fig. 1, we have shown a system of 30 telephones connected on the usual plan. Allowing the questionable supposition that a common-return system would prove satisfactory, we must provide 30 switches, each having 30 points, making a total of 1,521 points. Now to connect the 30 switches to the 40-wire cable, it will be necessary to make in the neighborhood of 3,000 connections. To the telephone wireman 3,000 connections does not mean very much, but when it comes to putting so large a number of wire connections into a factory telephone system, where everything electrical must take care of itself, the 3,000 connections had better be cut down to one-tenth that number.

Foreman 19 A
18 Dept. Supt. A: 20 B, 21 C, 22 D
14 Dept. Supt. B: 23 A, 24 B, 25 C
15 Dept. Supt. C: 26 A, 27 B, 28 C
16 Dept. Supt. D: 29 A, 30 B, 31 C, 32 D
17 Dept. Supt. E: 33 A, 34 B, 35 C
13 Dept. Supt. F: 36 A, 37 B, 38 C, 39 D

FIG. 1. TELEPHONE SYSTEMS FOR LARGE MANUFACTURING PLANTS.

In consideration of the fact that for factory purposes a direct-calling service is the nearest approach to the ideal—an individual line—which means, then, can we employ, which on following the same general plan, will give a satisfactory service, without introducing the objectionable features mentioned, that is, a large number of wires and possible points of trouble?

Referring to Fig 2, we have a diagrammatic rep-

resentation of the 39 telephone stations divided, according to the authority of their users, and in Fig. 3 a method is shown for sub-dividing the stations into communicating districts.

Referring to station No. 1, which corresponds to a telephone in the president's office, we find that this station may call any of the executive officers to their respective instruments, and that the No. 1 telephone cannot be called from any telephone in the entire system. The telephone in the general manger's office (No. 2), it will be observed, can be called only from the president's station, but the general manager is able to call any station excepting those that are under the direct charge of the general superintendent. The next district is composed of 10 stations belonging to the office proper, in which every individual user is able to communicate with any station belonging to his own district. An exception is made, however, in three stations, namely, the general superintendent, the purchasing agent and the shipping department, the general superintendent being able to signal and receive signals from any one of the six department superintendents, A, B, C, D, E and F. The purchasing agent and shipping department, though they cannot be called by any of the department superintendents, can at any time place their instruments in communication with those belonging to the department superintendents. The absence of local intercommunicative switching appliances also precludes the possibility of a workman entering into telephonic communication with any telephone station outside of that which is controlled by his chief, the department superintendent.

Referring once more to Fig. 3, it will be noted that the department superintendents are able to communicate with one another, the general superintendent and all such telephones as are placed throughout the factory and directly under their charge.

We have now arrived at another point, that is, the stringing of wires and placing of telephones in all parts of the factory proper. Nothing is liable to create more difficulties than the constant abuse to which such wires and instruments are subjected. The class of workmen employed in many large manufacturing plants will not permit the installing of any apparatus requiring special instructions for operation; therefore the instruments employed should be free from any form of plug or lever switches outside of such as are controlled by the receiver-supporting lever.

Now on having completed a general division of

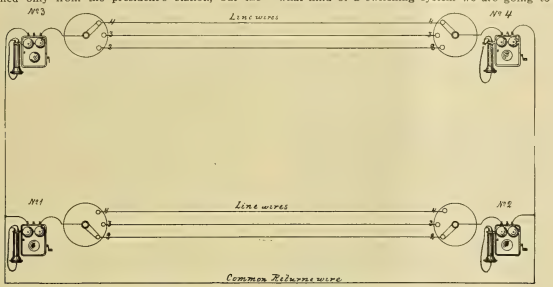


FIG. 4. TELEPHONE SYSTEMS FOR LARGE MANUFACTURING PLANTS.

It is not the object of this article to give any special recommendations as to the kind of instruments or switching appliances that should be employed. However, a few practical hints might be of value, and perhaps serve as a guide to the prospective investor.

Assuming that the division of telephone stations has been accomplished on the plan outlined in Fig. 3, and that the wirework is being installed by competent workmen, we have arrived at the point where it becomes necessary to decide what kind of a switching system we are going to adopt. As a basis for our consideration let us select the style of intercommunicating switch shown by Fig. 4, which in fact is the most widely known and simplest type yet produced. The system consists merely of a many-pointed single-lever switch. The line wires are connected one each to the points 1, 2, 3, etc. The local telephone is connected by one terminal to the switchlever and the other to a somewhat larger wire which connects to one terminal of every telephone in the system. The common wire must needs be somewhat larger than the individual wires, by reason of the interference that might ensue while two telephones, say No. 1 and No. 2, are in a conversational connection, and a third instrument, No. 3, is being operated for the purpose of signaling the telephone No. 4. As will be observed, the signaling current passes from the No. 3 generator through the line wire and through the signal receiver of telephone No. 4 and then back to its source at telephone No. 3; that is, it is supposed to take this course. However, if the common-return wire is not sufficiently large, a part of the signaling current may find an additional path through the telephones Nos. 2 and 1, but produce therein a disturbing influence, which, as a rule, is not had if the common wire offers a proportionally low-resistance return path.

When all switches are in a normal position, that is, if no telephone is in use, the switch levers are supposed to have been placed on the numbered switch point corresponding to the station number, for if this were not done any station having the switch lever on a point not corresponding with its own number could not be called unless, perchance, the station on whose point the lever rests were called, which, of course, would result in a false signal for the first-mentioned station. Regarding the contingency mentioned, several manufacturers have brought out a device whereby the replacing of a telephone receiver on its support tends always to restore the local signal receiver to its proper

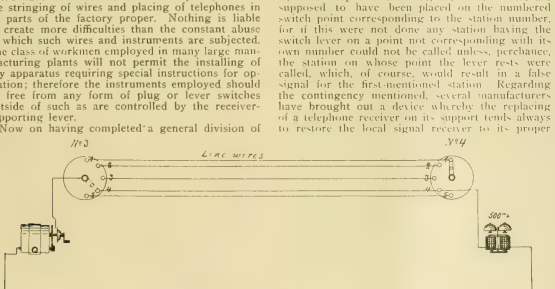


FIG. 5. TELEPHONE SYSTEMS FOR LARGE MANUFACTURING PLANTS.

a cord and plug. With this type of apparatus and the signal receiver (possessing a high retarding effect to the voice currents) connected, as shown in Fig. 5, it is hard to conceive how anything more simple can be devised.

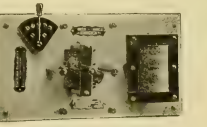
Having gone thus far we may as well go a little farther and give some consideration to the most vital objections to an intercommunicating system, where, with the simpler apparatus, it is possible for any telephone to interrupt or otherwise interfere with stations already in communication with one another. Although a large number of devices, both mechanical and electrical, have been designed for obviating the difficulty, it has been at the expense of simplicity.

The writer's intimate connection with designers of intercommunicating systems has impressed him with the idea that many designers of such systems make the most serious mistake of taking for granted that a particular feature in telephone instruments, if found objectionable in a given system, must be considered as objectionable if employed in connection with any other kind of a system. This point is quite apparent when we examine instruments intended for a small office system, wherein an absolutely non-interfering service must be rendered on the manually operated plan. The instruments devised for such service are numerous, and there are many intricate pieces of apparatus contained therein. Although such instruments are not really automatic, they certainly belong to that class, and should be treated as such when submitted for consideration.

A Battery Telephone Generator.

A novel machine, designed for telephone-exchange use, which can be operated by batteries as well as the electric-light current, and has ample capacity for exchanges of less than 1,200 instruments, is being introduced by the W. F. Warner company of Muncie, Ind. The power required to operate the machine is about 0.3 ampere at eight volts.

Many telephone exchanges throughout the country do not have access to lighting circuits, and many large exchanges have been compelled to use the hand generator, owing to the fact that they had no means to operate a separate or power generator. The cut herewith presented illustrates the new device.



A BATTERY TELEPHONE GENERATOR.

Extensions and Improvements.

The commercial telephone line between Lexington, Va., and Staunton has been completed.

The Janesville, Wis., Telephone company has been incorporated with a capital stock of $25,000.

The Eastern Illinois Telephone company of Kankakee, Ill., has increased its capital stock from $15,000 to $25,000.

The Village Council of Imlay City, Mich., has granted a 30-year franchise to the New State Telephone company.

The Northwestern Telephone company has been incorporated at Rush City, Minn., with a capital stock of $50,000.

E. W. Coleman of Columbia, Tenn., has applied to the City Council of Chattanooga, Tenn., for a telephone franchise.

A telephone line is contemplated connecting Albion, Ore., with Oakley, Minidoka and Kelton, and ultimately with Ogden.

Telephone communication between St. Louis and Kansas City and Topeka will soon be established by an "independent" line, it is said.

The Liberty, N. Y., Telephone company has sold its franchise, poles, wires and other property to the Delaware River Telephone company.

The New York and New Jersey Telephone company has established a station at the state camp at Sea Girt which gives direct communication with New Jersey's volunteers.

The plans for the new long-distance telephone company of Indianapolis provide for the building of a toll line through Anderson from Indianapolis to Muncie and Fort Wayne, connecting every city in Indiana.

The Central Union Telephone company has absorbed the Tom A. Marshall Telephone company, operating in Mercer and adjoining counties, and will immediately introduce a metallic circuit. The line will soon be extended to Galva, Ill.

The Fort Collins, Colo., telephone system is about to be extended to Livermore, a distance of 25 miles. The line will connect with La Porte and Bellevue and will be constructed conjointly by the citizens of Livermore and the Colorado Telephone company.

New York Electrical Exhibition.

Three characteristic exhibits at the New York electrical exhibition in Madison Square Garden are illustrated herewith. One is that of the Diesel Motor company of America. The picture shows a 20 horse power Diesel motor coupled directly by a rigid coupling to the armature shaft of a C & C generator. The motor was not built for electrical work, but is an ordinary 20 horse power stationary

NEW YORK ELECTRICAL EXHIBITION.—EXHIBIT OF SILEX INSULATION.

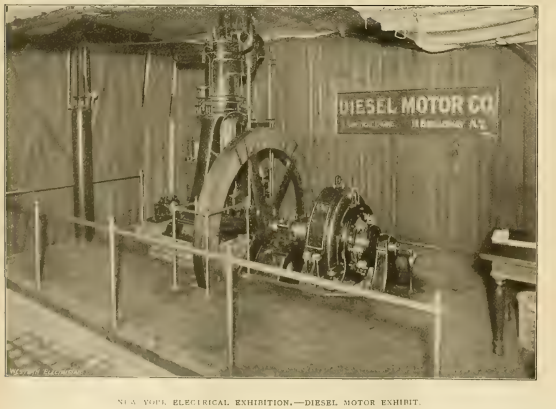
motor intended to run machinery by belt drive. It runs at only 170 revolutions per minute, is a single-cylinder motor and, like all internal-combustion motors, works on the four-stroke cycle. Time was not available to change the gearing for higher speed, desirable as that appeared for electrical work. It seemed therefore a bold undertaking to attempt to make it drive an electric-light generator. But public interest in the Diesel motor has been so aroused, and the opportunity to exhibit it at the Electrical exposition seemed so favorable, and, above all, the directors of the company have such absolute faith in the motor, that it was determined to exhibit it even under these adverse conditions. Delays in shipment and in the custom-house reduced the time for preparation. The only change that could be made in the time available was to supply the engine with a somewhat heavier flywheel than necessary for its ordinary work, and after two days of preparatory run it was set up in the exposition and carries its load of lights with less than 1½ per cent. variation. It requires less than a minute to start the engine when perfectly cold, and within two minutes it is running at full speed with its dynamo. It is believed that this is the first instance on record where a single-cylinder internal-combustion engine has ever accomplished these results. Those who have studied the working of the Diesel motor find the reason for this success in its controlled and perfect combustion and the absence of any explosive action.

The Silex Insulation company, 39-41 Cortlandt street, New York city, in its exhibit, shows a conduit constructed on a new principle of insulation. The conduit consists of an inner and outer tube, silex being packed between the tubes. This mineral, when pulverized, has no round particles in it; they are all sharp, angular, wedge-shaped, splintery. This enables it to be packed to a solidity approaching that of the rock from which it is ground. Thus, when the silex is packed, it forms an arch around the inner tube, so that it is impossible to decentralize the inner tube. Silex will not conduct heat or electricity, nor will it burn or melt. It is absolutely unchangeable. The "three-eye" conduit has at the ends mica wads, both receding and protruding, so that when these ends are connected up with a right and left coupler the insulation is completely continuous. The inner tube is a smooth metal tube; rubber-covered copper wire can be burned and melted out of it without affecting the conduit. The principle on which this conduit is made is the introduction of insulating materials, the particles of which are free to move relatively, which is the property of the flexible mineral insulator.

The Faries Manufacturing company of Decatur, Ill., manufacturer of the Faries universal adjustable electric-lamp holders, aluminum and steel electric lamp shades, and fire and water-tube boiler cleaners, has recently established an eastern office at 136 Liberty street, New York city, under the manage-

NEW YORK ELECTRICAL EXHIBITION.—FARIES COMPANY'S SPECIALTIES.

ment of A. W. Koenig, and it requests its patrons in the eastern states to send their inquiries and orders to this office, in order to save time and expense in shipping. Mr. Koenig has arranged a neat, attractive and interesting exhibit at the electrical show. The exhibit is located on the promenade just above the main floor, adjoining the new York Telephone company's theatrophone exhibit. Some of the holders are adjustable in four or five places, so that it is very easy to arrange them to throw the light anywhere that is desired by merely adjusting the fixture at the angle necessary. These fixtures are made in about 30 different designs of portable and stationary desk and table lamps, side-wall fixtures, chandeliers, pendant hall lamps and dental lamps. They are all very unique and attractive in design, while not at all elaborate, thus making the cost reasonable. The aluminum and steel shades or reflectors are made in three styles—the parabola or half shade, the cone-shaped and the ceiling shade. They are not only shades but reflectors. The holder reaches well over the shank of the lamp, leaving the shade to begin at the top of the filament, thus enabling a smaller shade of the same angle to cover the lamp as well as a larger one with the old style of holder. The advantage of the fire and water-tube boiler cleaner manufactured by this company is that it expands when shoved forward in the tube and collapses when pulled backward, so that it will never get stuck. It is easily adjusted for variations in sizes of tubes and has a ram which enhances the facility of operation, especially when tight and uneven places in the tubes are encountered. There is no leather or rubber about the cleaner, and it does the entire work without the use of steam or water.

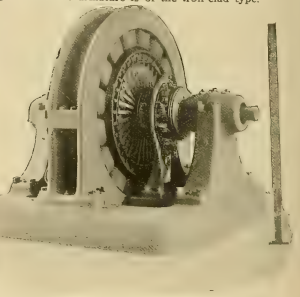


NEW YORK ELECTRICAL EXHIBITION.—DIESEL MOTOR EXHIBIT.

Large Rotary Transformer.

In the station of the Pennsylvania Heat, Light and Power company, Philadelphia, Pa., has recently been installed by the General Electric company the largest 60-cycle rotary transformer yet constructed. It is a 16-pole machine, of 400 kilowatts capacity, running at 450 revolutions per minute, and was designed to convert an alternating two-phase current of 60-cycles frequency and voltage variable between 165 and 220 volts into continuous current at from 225 to 300 volts. It is designated QC 16-400-450, and stands eight feet high on a base eight feet four inches by eight feet six inches.

The field frame of this machine is heavily ribbed, divided horizontally and susceptible of movement along the base to allow of inspection of the armature and field coils. The bearings are extra long and of the "G E" self-oiling and self-aligning type; that at the commutator end of the shaft is provided with an end-play device to keep the armature in constant motion in the direction of the length of the shaft and distribute the wear of the brushes over the commutator surface to avoid the wearing of grooves. The armature is of the iron-clad type.



LARGE ROTARY TRANSFORMER.

The commutator, carried on a separate spider, is of very ample surface and has a large number of segments. To facilitate the removal of a brush for examination and replacement without varying the tension under which it runs, a brush-holder of unique design has been devised. To remove the brush the prolonged end of the brush-holder spring is disengaged from the brush-holder by a slight end motion.

Another valuable feature in this machine is the design of the brush-holder studs and the method of attaching them to the yoke. The former, instead of passing through insulating bushings in the yoke—as has been customary in this type of machine—is provided with a lug bored to fit down upon a radial stud held by bolts passing through the insulating bushings. To slide the brush-holder stud off, it is simply necessary to loosen the nuts on the bolts passing through the bushings.

The cut shows the two-phase side of the converter. Upon the collector rings press numerous leaf brushes, having a long contact on the rings and a large current-carrying capacity.

To obtain the necessary variation in the continuous current of the rotary converter, the manufacturing company has furnished with it two special 60-cycle stationary transformers, each of 220 kilowatts capacity. These have been designed to operate with a primary potential of 2,000 volts and a secondary potential varying from 165 to 220 volts. The variation is obtained through a dial switch, over which passes a contact plate, cutting out or throwing in more or less turns of the primary winding and thereby varying the secondary potential. The switch is operated by a wheel handle, and the potential may be varied rapidly in either direction, the contact plate snapping from contact to contact in one direction as well as in the other. The dial switch is applied to the transformer itself instead of being a separate device, and the entire construction is singularly compact.

Chicago Electrical Association.

The members of the Chicago Electrical association had a fine time at the annual dinner of the society, which was held in the building of the Technical Club on the evening of May 20th. W. Clyde Jones was toastmaster, and the set toasts were as follows: "A Glance Into the Past," George Cutter; "The Power of the Press," Cloyd Marshall; "Tribu-

lations of the Electrical Inventor," K. B. Miller; "The Evolution of a Dynamo," E. P. Warner; "Specializing," Albert Scheible; "Electricity in Warfare," C. C. Mattison; "Shop Talk," Thomas E. Grier; "A Glance Into the Future," S. G. McMeen. An interesting informal discussion brought out the views of the members on the existing methods of the United States Patent Office.

The banquet committee in charge of this very successful dinner was J. M. Hollister, Albert Scheible and E. W. Jewell. The association has now over 50 members and is prosperous and vigorous.

National Electric Light Association.

The general reception committee, representing the electrical interests of Chicago, held another meeting on Monday afternoon for the purpose of considering the report of the sub-committee which had been instructed to complete arrangements for the entertainment of the visiting delegates to the convention of the National Electric Light association.

It was announced that the arrangements for the reception at the Auditorium on Monday evening, June 6th, had been completed. The reception will be held in the parlors of the hotel and light refreshments will be served. Music will be furnished and an excellent opportunity afforded the visitors to meet local electrical men. The reception will last from 8:30 until 10 p. m.

It was also proposed to have a ride on the lake, and Tuesday evening was selected for this entertainment. The committee was instructed to charter a steamer and make arrangements for music and refreshments for the same.

On Wednesday evening it was agreed to have a lecture by Joseph Wetzler of New York on "Electricity from Coal." It was thought that this would prove highly interesting to the general public as well as to the members of the association.

In order that the ladies of the party may not be left entirely to their own devices during the sessions of the convention, it has been proposed to give two tally-ho parties, one on Tuesday through the South Park system, to be followed by a luncheon, and another on Wednesday through the North Shore drive, Lincoln Park and the Sheridan drive. It is probable that the party may go through Buena Park and as far north as Evanston, provided the weather is favorable. It is anticipated that these drives will prove very attractive to the ladies.

President Insull has received many personal assurances from central-station managers that they will attend the Chicago meeting. He has addressed personal letters to many of his friends in the business, and hopes that this year's convention will be noteworthy by reason of the large attendance of central-station men.

As an accommodation to members the local committee has agreed to arrange for hotel accommodations for those who wish to have rooms secured in advance of the meeting. Mr. C. H. Wilmerding is the chairman of the committee.

Northwestern Electrical Association.

The Northwestern Electrical association has perfected its arrangements for the summer convention to be held on the steamer Northwest, leaving Chicago June 10th.

A meeting was held in Chicago Tuesday, May 24th, at the office of J. M. Hill, at which President Copeland, Pliny Norcross, E. L. Debell, W. W. Low, William Goltz and P. H. Korst were present.

Mr. Hill returned from an eastern trip on Sunday, and is enthusiastic over the prospects of a large number of central-station men being present. He has assurances that Mr. Edison, Professor Thomson, Mr. Sprague and Mr. Wood will attend, and that Mr. Stanley will also accept the invitation of the association. Mr. Brush, it is feared, will hardly be able to attend, although he commended the plan and said that if there was any possible way for him to leave his present work he would like to go.

The programme will consist principally of discussions. A feature of the programme will be the "question box." Those who do not desire to ask questions during the sessions can do so without revealing their identity.

It is expected that a paper on "Measuring Instruments" will be read by Mr. Edward Weston. A paper on the "Electrical Smelting of Ores," which is of such vital importance to the Lake Superior district, and which has so interested Mr. Pliny Norcross and Professor Thomson, will be read by W. S. Horry, the electrical engineer who constructed the furnaces for the Union Carbide company at Sault Ste. Marie.

Central-station men show a decided interest in this convention and express their desire to go. While the plan is a novel one, there is an opportunity for greater good to owners and managers of electric-light and power companies than has ever yet been afforded by a convention.

The matter of expense has been in some cases misunder-stood. There will be plenty of entertainment furnished by the steamer committee as well as by the citizens of the Soo, and the harbor of West Superior is to be one of the most elaborate events of its kind in the West.

State-room assignments are to be made at once, and, where ladies accompany members, it is important, that quick notice be given the chairman of arrangements, J. M. Hill, 1240 Monadnock block, Chicago, as it is desired that they shall be especially well taken care of.

Commonwealth Electric Company.

The policy of consolidation and absorption adopted by the Chicago Edison company some time ago has resulted in that company securing practical control of the electric-lighting industry in Chicago. The Commonwealth ordinance was the last measure of its kind passed by the City Council, and it is said to be the best working ordinance that has ever been granted in this city. The franchise is for 50 years from June 28, 1897, and it is proposed to organize all the small companies controlled by the Chicago Edison company under this ordinance. This will be a mere formality so far as the service is concerned, as the group of properties to be formally taken over in Hyde Park consists of the People's Light and Power company, the People's Electric Light and Motor Power company, the Hyde Park Thomson-Houston Electric Light company, the Englewood Electric Light and Power company, the Hyde Park Electric Light and Power company and the Mutual Electric Light and Power company, which have been controlled by the friends of the Edison company. The Commonwealth company has already taken formal possession of the West Chicago Electric Light and Power company which has been operating a station on West Madison street. The Western Light and Power company in Lake View will also be included in the combination. The Commonwealth will do its first business on the West Side, using for a time the plant on Madison street, but shortly the current will be obtained from the new station in the street.

When the details have been arranged there will be four going concerns in the outside territory, one station of the Hyde Park Thomson-Houston company, and two additional stations on the South Side, with the Western Light and Power company in Lake View. The change in management will dispense with five stations, three on the South, one on the West, and one on the North Side. Eventually the North Side station in Lake View will be one.

It will be realized at once that the Commonwealth will operate over an extremely large territory, as it will do the electric-lighting business outside the district bounded on the north by North avenue, on the west by Ashland avenue, and on the south by Thirty-ninth street, the present limits of the Chicago Edison company's territory. The new concern will occupy all the territory in which its franchises permits it to operate overhead wires, being bound by the following limits: North avenue from the lake west to Wells street, south along Wells street to Lake street, west along Lake to Ashland avenue, south along Ashland to Sixteenth street, east along Sixteenth street to Butterfield, south along Butterfield to Fifty-fifth street, and east along Fifty-fifth street to the lake.

The gross revenue from the electric-lighting business in the outside territory is between $450,000 and $500,000 per annum, but this is largely an arc-light service, and the Commonwealth company will develop incandescent service.

In order to accomplish the changes, extensions and improvements contemplated it is proposed to issue securities of the Commonwealth company aggregating $5,500,000, including 45-year five per cent. bonds for $2,500,000 and stock amounting to $3,000,000. These issues will be placed upon properties estimated to be worth double the bonds of the Chicago Edison company. The bonds will be put out for the purpose of covering, or capitalizing the cash investments made, and taking over finally the South Side group of electric properties. The organization of the company has been effected by the election of the following officers: President, Edward P. Russell; secretary and treasurer, Edward B. Burling.

This, it is believed, is merely a temporary arrangement, as it is understood that Mr Insull, who has been the guiding spirit in the enterprise, will be chosen president as soon as the corporation is well under way.

Western Society of Engineers.

On Saturday evening, May 21st, the Western Society of Engineers dedicated its new assembly room at 1741 Monadnock building, Chicago. About 175 gentlemen were present and passed an enjoyable evening. There was no formal programme, but Mr. W. J. Karner, the assistant engineer of the Illinois Central railroad, gave an interesting and timely description of his travels in Cuba, illustrated by many stereopticon pictures from photographs he had collected there. Refreshments were served, and good music enlivened the occasion.

The assembly room adjoins the society's library, which has nearly 3,000 books of engineering reference, and is well equipped for the purpose. It has a blackboard and screen for stereopticon views built in the wall back of the speaker's table. A Colt electric focusing lamp, mounted on a portable stand, is provided to project the lantern slide pictures or drawings used to illustrate the papers read before the society. This lamp is operated on a 110 volt lighting circuit, with suitable resistance, and the connection is made by a length of lamp cord giving the necessary radius of action, and a plug switch mounted on the lamp stand. A noticeable convenience is a push switch hanging by the speaker's table by which the lecturer can light or extinguish a shielded incandescent lamp in the back part of the room, thus signaling to the operator at the stereopticon when to change the picture on the screen.

Development of the Central Station.

[*Continued from page 309.*]

to provide for the economical production of steam, low cost of operating, good facilities for repairs and consequently low cost, and for permanency of service. You have but to go into any of the modern central stations in midwinter, to see them turning out anywhere from 10,000 to 30,000 amperes with a minimum of labor, to appreciate the fact that central-station business is of a permanent and lucrative character.

To go back to the question of alternating currents, the work done in connection with the two-phase and three-phase currents and the perfection of the rotary transformer has resulted in introducing into central-station practice a further means of economizing the cost of production—by concentration of power. Accepted present experience, it is (except in some extraordinary cases) uneconomical to distribute direct low-tension current over more than a radius of a mile and a half from the generating point. The possibility of transmitting it at a very high voltage, and consequently low investment in conductors, has resulted in the adoption of a scheme, in many of the large cities, of alternating transmission combined with low-tension distribution. The limit to which this alternating transmission can be economically carried has not yet been definitely settled, but it is quite possible even now to transmit economically from the center of any of our large cities to the distant suburbs, by means of high-potential alternating current, and distributing the current from the sub-center distribution by means either of the alternating current itself and large transformers for a block or district, or else, if the territory is thickly settled, by means of the present low-tension mains and feeders, the direct current for this purpose being obtained through the agency of rotary transformers.

There are various methods producing the alternating current for transmission purposes. In some cases the generators are themselves wound for high potential; in others they are wound for 80 volts, and step-up transformers are used, carrying the current up to whatever pressure is desired, from 1,000 to 10,000 volts. In other cases dynamos are used having collector rings for alternating current on one side and a commutator for direct current on the other side of the armature, thus enabling you, when the peak in two districts of a city comes at two different times of the day, as is the case by means of the same original generating unit, furnishing direct low-tension current to the points near the central station and alternating current to the distant points. In other cases, only a small amount of alternating current is required on the transmission line, it has even been found economical to take direct current from a large unit, change it by means of a rotary transformer into alternating current, step up from 80 to, say, 2,000 volts, go on the distant point, and step down again to 80 volts alternating, and then convert again by means of a rotary transformer into low-potential direct current.

The introduction of alternating current for transmission purposes has probably best exemplified in large cities in the station recently erected in Brooklyn, where alternating current is produced and carried to distant points, and then used to operate series arc-light machines run by synchronous motors, the low-tension direct-current network being fed by rotary transformers, and alternating circuits arranged with block converters, and even in some cases separate converters for each individual customer in the scattered districts.

It would be very interesting to go at length into the details of cost in this, the latest development of central-station transmission, but time will not permit, nor have I the time at my disposal to go at length into the central-station business as developed by the electric-street railways now so universally in use, or another phase of the business as exemplified by the large transmission plants, the two greatest examples of which in America are probably those at Niagara Falls, N. Y., and Lachine Rapids, near Montreal. So far as street railways and power transmission are concerned, I would draw your attention to the fact that the same underlying principle of multiple-arc mains and feeders originally conceived by Mr. Edison is as much a necessity in their operation as it is in the electric-lighting systems, whether those systems be operated on the old two-wire plan, the three-wire plan or by means of alternating currents.

Injunction in Street-railway Litigation.

A dispatch from New Haven, Conn., May 24th, says that Judge Townsend of the United States District Court handed down a decision in the case of the Electric Car company of America and the Thomson-Houston company against the Hartford and West Hartford Railroad company. The plaintiffs claimed an infringement of patent on a multiplying switch for electric motors. The decision orders an injunction and an accounting.

WAR NEWS.

[*Continued from page 311.*]

tion bears heavily upon the newspapers, but is patriotically accepted by press and public as a necessary evil. But the censorship is only a portion of the duties of the chief signal officer. General Greely supervises all the varied means of communication that are used by the land forces of the government. It was under his direction that the coast fortifications were inter-connected by telephone and telegraph; and the electrical connections with the submarine mines and torpedoes in the harbors were made by his expert subordinates. General Greely has charge, also, of the varied methods of field signaling, which will, of course, be of the greatest value in the military operations in Cuba and the Philippines. In short, the duties of the chief signal officer are multifarious, and he is required to be a man of the highest scientific attainments as well as a practical man of affairs.

General Greely was born in Massachusetts in 1844. He served in the army during the Civil War, enlisting as a private and rising to the rank of brevet major of volunteers in 1865. He has remained in the army ever since, and since 1868 he has been connected with the Signal Service. In 1881 he was sent to the Arctic regions to establish a scientific station, in accordance with a plan made by the Hamburg International Congress of 1879. On the return voyage in 1883 16 of the party perished by starvation, the survivors being rescued by a relief expedition. In 1886 the explorer published an account of his expedition, "Three Years of Arctic Service," in two volumes. This work was highly praised, both as a narrative and for scientific importance. General Greely attained his present rank of brigadier-general in 1887, when he succeeded General Hazen as chief ofthe Signal Service Corps. Since that time he has published a volume on "American Weather" and he has busied himself in perfecting his branch of the service. His persistent appeals to Congress for funds to equip lines of communication for the coast defenses are well known.

The portrait herewith given was made from a drawing prepared for the Chicago Times-Herald and kindly loaned to the Western Electrician.

Cable Restrictions.—The agreement between General Greely, representing the government, and the six cable companies having lines radiating from the United States, is said to be as follows:

In order to safeguard the public interests until further instructions, these companies refuse to receive or transmit the following:

First—Any and all messages, either to or from officials of Spain or any of her colonies, except such as are addressed to or signed by the president of the United States or any member of his cabinet in Washington city.

Second—All code or cipher messages to any point in the West Indies, Brazil or Venezuela, with the following exceptions:

(a) Messages addressed to or signed by the president or members of his cabinet at Washington.

(b) Messages exchanged between any ambassador or minister of Austria-Hungary, France, Germany, Great Britain, Italy and Russia in Washington city, and their duly recognized consular officials.

(c) Messages exchanged by neutral European governments and their consular agents, provided that such messages are officially signed and addressed.

Third—All messages in plain or open text that on their face contain information against the United States in the present war with Spain.

In addition to these general restrictions, the cable companies at Key West, Fla., and the Haytian Cable company, in New York city, decline to receive or forward any messages communicating information as to the movements of United States naval vessels or current military operations.

The United States has officially expressed its disinclination to exercise further military control or government supervision over the business of any of these telegraph cables than the necessities of the war will permit. It has expressly made known its preference that the companies shall have exclusive control over their own cables. To this end the United States has accepted the formal agreements of the presidents or authorized agents of these cable companies, given in writing, that they will neither receive nor transmit messages forbidden by the foregoing restrictions. It is recognized that these companies cannot exercise an exhaustive censorship over all messages in plain or open text, but it is expected that they will especially refrain from transmitting information as to the movements of naval vessels or current military operations.

The United States has expressed its desire to interfere to the least possible extent with the receipt or transmission of commercial messages.

More Cable Cutting Reported.—The Washington correspondents report that on May 24th the Navy Department issued this official statement: "The United States steamship St. Louis has cut the cable at Santiago de Cuba and San Juan de Porto Rico." This information is indefinite, as there are three cables landing at Santiago—one going west to Cienfuegos, another south to Jamaica, and the third east to Guantanamo and thence to Hayti. Both the eastern and southern outlets connect with transatlantic lines, so that it is still doubtful whether communication by cable between Spain and Cuba has been interrupted. There is little doubt, however, that the American naval officers are endeavoring to isolate Cuba, telegraphically and otherwise, and that the result will be accomplished.

Cable Repairs in War Time.—The English press, lay and technical, is watching the development of the present war closely for information. One lesson, drawn by the London Electrician, is worthy of attention. "In view of the enormous importance of cable communication in time of serious naval war," says this journal, "we are glad to learn that our Admiralty has already made provision that some of the officers should understand cable working and be in possession of the necessary appliances. In fact, on many of our battleships there are men who can send and receive Morse and mirror signals; but, in view of the suddenness with which war might arise, would it not be desirable to offer some inducement to secure that there should be men with every squadron who would understand something of the repair and testing of submarine lines? A fleet which could pick up a cable in mid-ocean and transmit or receive instructions for concentration, etc., as well as effect cable repairs, would surely have its offensive and defensive power greatly increased. We all know how for a time Villeneuve eluded Nelson before Trafalgar by doubling back from the West Indies; and in modern warfare the ability to pick up and work a cable might decide the fate of a great battle or even of a nation. The public is beginning to realize what has long been clear to experts, that coaling stations and bases for repairs are only second in importance to fleets and armaments of the latest type; but in addition to these the empire possesses a valuable resource, not only in the submarine lines, but also in the presence of British cable ships, with cable on board, and store cable tanks in various parts of the world. It is probable, in certain cases, that our fleets in war time will in the future be accompanied by a cable ship or ships of greater carrying capacity and higher speed than is necessary for the ordinary operations of vessels of this class. If the occasion should arise, we venture to think it will be found that those responsible have devoted much quiet thought and work to some of the problems which might arise—contingencies which should be of serious importance to a belligerent."

The Role of Electricity.—In responding to the toast "Electricity in Warfare," at the recent dinner of the Chicago Electrical association, C. C. Mattison, electrician of the Chicago Shipbuilding company, said, among other things: "Electricity has an important place both in land and naval operations. At night the electric searchlights and signal lanterns are indispensable. The searchlight in skillful hands sweeps the surrounding water, thus minimizing the danger of night attacks from torpedo boats. The signal lantern flashes its messages with even more distinctness than the flag in daytime. In a coast defense fort which a hostile fleet is approaching a call to quarters does not mean manning ramparts with guns exposed to the fire of the enemy, but the officer sits in the protected observing tower and operates his range-finder with awful accuracy. Electricity carries the ammunition, revolves the gun turret and finds the enemy. Electricity has made it necessary that the sailors be men of intellect. Science has robbed the tar of his picturesqueness, yet it has given us a man of nobler aspirations and intelligence."

Telephotos for the Buffalo.—The Boughton Telephotos company of Buffalo has decided to equip the new cruiser Buffalo with a full set of telephotos instruments especially prepared for her, because of her name. In accordance with this decision the company wrote to Washington to learn if the gift would be acceptable and received a satisfactory response. This decision was naturally highly gratifying to the company, and a special set of instruments will be at once prepared for the cruiser. While everything about their construction will conform to strict navy standards, every possible nicety of finish and furnishings will go with this special set, and the polished keyboard binnacle will bear a silver plate with this inscription:

This set of instruments
is presented to the
U. S. S. Buffalo
In honor of the name
it bears.

The value of the set will be $550, and it is certain that no matter what rush orders are received the cruiser Buffalo will be well cared for.

Miscellaneous Notes.—In McCutcheon's letter to the Chicago Record from the fleet at Manila, dated May 21st, is this passage: "I have had a talk to-day with an American named Silver, lately employed by the Manila Electric company, who escaped to our ships a few days ago, and is now on the American transport Zafiro. He says that, with the assistance of men from his company, the Spaniards had completed before the battle twenty-five electric torpedoes, to be used in guarding the entrance to the bay. The work of placing them, however, had not been finished, and the promptness of Admiral Dewey in entering the bay defeated the plans to keep him out."

It is said that the telegraph office at the Island of Grand Canary, near the center of the Canary Islands, the chief city of which is Las Palmas, has been seized by the Spanish authorities. All telegrams except the barest commercial messages have been stopped.

Twelve searchlights, to be mounted on fortifications along the Atlantic coast, were shipped from New York a few days ago under direction of the depot quartermaster. The names of the fortifications where they are to be mounted are withheld.

It is stated that during the recent state of Señor Polo de Bernabe, the late Spanish minister to the United States, in Montreal, the cable bills of the party for messages sent by both the Great Northwestern and Canadian Pacific Telegraph companies amounted to $300 a day. It is said that the Spaniards communicated with their agents in the United States, by means of the cable to London, whence their messages were cabled back to America, and vice versa. To be sure of secrecy they sent half of each of their cipher message by one and the other half of the message by the other company. The former company is connected with the Western Union and the latter with the Postal Telegraph company in the United States.

Two British steamships which arrived at New York May 20th brought the shore end of the story of the bombardment of San Juan, Porto Rico, by Admiral Sampson's squadron on Thursday, May 12th. One of these, the New York and Porto Rico liner Arkadia, left San Juan on May 14th, two days after the bombardment, and among its passengers was William Cantrell, an Englishman, who, it is said, represented an American electric-light company at Ponce.

The China Mail, which is printed in Hongkong, was eagerly scanned upon its arrival with the last batch of mail from the far East. The latest number received was printed before the news of Dewey's victory had been received. There is a good deal of interesting information about the preparations of the American fleet for the encounter with the Spaniards, and there seemed to be no doubt as to the outcome of the conflict. Philippine news of April 12th shows that large bands of insurgents twice succeeded in gaining entrance to Manila under the mistaken idea that the American warships had arrived. Shops were closed and doors barred, but the natives left when they discovered their mistake. The Spanish authorities were attempting to strengthen their fortifications, but they had only mounted a half dozen six-inch guns. They had also laid mines in the harbor. Several miles of cable were bought of a cable ship for mining purposes. Advices were received from the Island of Cebu announcing the massacre of the governor and Spanish officials. The natives rose suddenly and gained control of the whole island. They cut the cable and news was taken to Iloilo, on the neighboring island of Panay, by a sailing vessel.

Mention has already been made of the appreciation displayed by Admiral Dewey for the electrical equipment of modern war vessels, and in this connection it may be interesting to reproduce from the Western Electrician of November 22, 1890, the following paragraph from an article entitled "Electricity on Warships:"

Commodore George Dewey, chief of the Bureau of Equipments of the United States Navy, in his annual report to Secretary Tracy, makes the following comment on the introduction of electricity in the naval service: "The lighting of ships of war by electricity, which was inaugurated by this government, has now become so essential that no warship is considered complete which is not so lighted. Special attention has been given during the year to the subject of means of interior communication on shipboard, and a telephone system is soon to be added experimentally to other devices in use on board one of the new cruisers. Night signaling by electricity has also been and is still actively under consideration. A most notable feature in connection with the extensive telegraphic time service, which has become an established and apparently an indispensable commercial factor centering at the Naval Observatory, has been a concerted attack upon the prevalent system by a large number of observatories located throughout the United States, the object being to break up the system in order that time, which is now furnished without cost from the Naval Observatory, may be distributed and charged for at these minor observatories as a means of contributing to their maintenance."

Electric, Cable and Horse Cars.

[From the New York Sun.]

The revenues from horse-cars have been for a number of years very much on the decline in New York state, and they now compare most unfavorably with the receipts from electric and cable companies. Oddly enough New York city is almost the only large city of the state which still adheres at all to the old-fashioned surface cars. In 1896, according to the report of the railroad commissioners, the total receipts of horse-car lines in the various cities of the state amounted collectively to $4,467,200, against $24,400,000 from street railroads operated by traction. The total earnings of the elevated railroads in that year were, approximately, $12,000,000. Last year, it appears from the report of the railroad commissioners, the earnings of the elevated railroads were substantially the same as they had been the year before, while the trolley and cable roads increased about 10 per cent. over the year before, but the horse-car receipts still further decreased, amounting in all, according to the report, to $3,180,000, an insignificant figure when compared with the totals of the other companies.

The popularity of trolley and cable lines is to be ascribed to the increased volume of business which they can handle, the better speed which they attain and the natural obstacles which they overcome. This last does not apply to any great extent to the city of New York, but in most of the large cities of New York state, built usually on the line of the rivers, there are hills, and access to these hills has always been difficult by the former method of horse-car lines, whereas no such difficulties impede or embarrass the trolley lines now general throughout the state, and to be found, in fact, in nearly every city.

Another consideration which has probably had much to do with the change in motive power is the reduction in expense following the abandonment of horse cars. As shown by the railroad commissioners' report, the operating expenses of the elevated railroads of the state amounted to about 65 per cent. of the receipts, leaving a large margin of profit. The operating expenses of the trolley and cable lines were about 55 per cent. of the receipts, leaving

45 per cent. of the earnings as profit from operation. The expenditures of the horse cars are nearly 80 per cent. of the receipts, forage being an item of importance, the renewal of horses another, and stable expenses a third. One of the New York street-car lines, for instance, which took in last year $570,000 from fares, expended $52,000 for fodder, $8,500 for horse-shoeing, $12,000 for the renewal of horses, $34,000 for stable expenses, and $3,000 for harness, a total of $110,000 for these items alone.

Development of a School of Electrical Engineering.[1]

By Harold B. Smith, M. E.

Within the last 15 years there has arisen the new profession of the electrical engineer, and it has become necessary to provide professional schools where a proper preparation for his work may be found.

The frequently-quoted remark of Lord Kelvin, that the electrical engineer should be nine-tenths mechanical and one-tenth electrical, was made before the advent of the electrical engineer as we know him to-day, and no longer holds true. While it has been held by some that this ratio should be reversed, that, also, is undoubtedly an extreme statement of the case. The relative training in the two lines of engineering work which is desirable for the electrical engineer necessarily depends upon the class of work to which he proposes to devote himself, but in any event, should be much more nearly equal than indicated by either of the above statements.

Perhaps an approximation to the following relations in his training is as likely to bring success to the young electrical engineer as any that can be suggested: Electrical-engineering training, 10 per cent.; mechanical-engineering training, five per cent.; the possession or cultivation of an interest in his work, five per cent.; the habit of independent logical thought, five per cent., and the remaining 75 per cent. should be sterling manhood.

It remains, then, for the school of electrical engineering to provide about 10 per cent. of his training in the best manner possible.

There are, at present, four general lines of work in which the graduate in electrical engineering may find a place for himself, though many positions involve decided ability in more than one of these lines:

1. The engineer having to do with the design and manufacture of electrical apparatus.

2. The engineer installing and operating electrical apparatus and systems.

3. The engineer connected with electro-chemical or electro-metallurgical operations.

4. The consulting and experimental engineer and the teacher.

These lines of work have much in common which may be taken up profitably in a regular four-years' undergraduate course of study, which, in most institutions, leads to the degree of bachelor of science, leaving the special and more advanced work to graduate study and experience, before granting the degree of electrical engineer.

From a careful study of the courses of instruction offered to electrical-engineering students in the various educational institutions, and personal experience in the development of the electrical courses of four such institutions, appears to the writer that four distinct lines of undergraduate study should be provided in a school of electrical engineering:

1. Lectures dealing with the theory, practical operation, and description of electrical apparatus, machinery and systems should constitute about 47 per cent. of the work.

2. About 20 per cent of the time should be given to laboratory work, involving the practical operation, testing and theory of electrical apparatus and systems. The basis of this course should be to provide the students with as wide an experience and knowledge as possible, even at a certain sacrifice of training in original and independent methods.

3. A course in electrical design, so planned as to thoroughly impress upon the student the theory and principles on which electrical apparatus and systems are based, should require about 20 per cent. of the time. While primarily for this purpose, it may serve as a basis for further study leading to competence as a designing engineer.

4. About 20 per cent. of the time should be devoted to the preparation of a thesis involving original and independent work on the part of the student, and supplying, so far as possible, the lack of training in this respect in the laboratory courses.

The courses should be based on a thorough training in mathematics, physics, chemistry, drawing, shopwork, mechanical engineering and modern languages, and lead to the more advanced graduate courses in which the student may devote a larger proportion of his time to purely professional and special work, though under an arrangement of time as thoroughly systematized as the undergraduate courses.

The present courses in electrical engineering at the Polytechnic Institute have been developed on the basis outlined, and since the reorganization of the department in 1896 the laboratories and other facilities of the department have been shaped to meet the demands of the courses as rapidly as possible.

[1] From the Journal of the Worcester Polytechnic Institute.

The laboratories in operation and process of development are as follows:

1. A power laboratory containing boilers (200 horse power), engines (225 horse power), generators (standard systems and voltages, 225 horse power) and marble switchboard arranged closely in accordance with usual station practice, but with special provisions to make all available for purposes of experimentation and instruction.

2. A laboratory for general direct-current experimental work provided with a good assortment of direct-current machines, apparatus and instruments, all of which are connected to a slate switchboard having over 300 terminals.

3. A laboratory for general alternate-current experimental work in process of equipment, but already possessing a good collection of alternate-current apparatus and instruments connected to a slate switchboard of over 150 terminals.

4. A laboratory for calibration, standardization and special investigation in process of equipment and already containing a number of standards and special pieces of apparatus of considerable value, connected to a slate switchboard having about 200 terminals.

5. An electro-chemical and electro-metallurgical laboratory in process of equipment, but provided with a large storage battery, electric forge, electric furnaces, etc.

6. A photometric laboratory equipped with Reichsanstalt standards.

All of the laboratories are interconnected by an extremely flexible system of switchboards, so that the apparatus of any one laboratory is immediately available in connection with the work of any others, and special experimental work may be undertaken with a facility almost equal to that of the routine laboratory experiments.

Restriction Upon Right to Put Wires Underground.

The case of the State of Missouri against Murphy was originated by the Laclede Gaslight company in the Circuit Court for mandamus in the name of the state, to compel the street commissioner of the city of St. Louis to grant the company a permit to make the necessary excavation in a street, and put in a conduit system underground.

Although the company named originally furnished light by means of gas through underground pipes, when electricity came into use it furnished electric light through overhead wires, and then sought to put its wires under the surface, insisting that its charter gave it a vested right to do this, without being controlled by the municipal authorities.

From a decision against the company, in the Supreme Court of Missouri, in which the case up to the Supreme Court of the United States, and on April 11, 1898, the latter affirmed the judgment of the former. Chief Justice Fuller prepared the opinion of the court.

First of all, it is laid down as a basic principle that mandamus lies to compel a party to do that which it is his duty to do, but can confer no new authority, and that the party to be coerced must have the power to perform the act mentioned.

Assuming that the charter of the company to be in force, as contended, with the only limitation on its power to occupy the streets as it desired, being that the work should be done "with as much dispatch, and with as little inconvenience to the public as possible," it is held that the street commissioner could not be compelled by mandamus to issue the permit wanted, because he had no power, under the charter and ordinances of the city, to issue such permits in the absence of the assent of the Board of Public Improvements, which had general control, and with which the company filed no application giving details of the streets it wished to occupy, and the conditions on which the rights were to be secured, supported and insulated, and a plat of the route, as required by a city ordinance.

Judgment to this effect, it is said, in itself involved no federal question, for confessedly there was no question of right to leave private matters to be given by a particular officer. But the Supreme Court of the United States goes farther, and says that it concurs with the conclusion of the Supreme Court of the state that the company was subject to reasonable regulations in the exercise of the police powers of the city, and, so far as that involved any federal question, such question was correctly decided.

The federal Supreme Court says that it is unable to accede to the contention that the company was entitled, by contract with the state, to lay electric wires underground without reference to the directions or regulations of the city on that subject, or that the street commissioner was obliged to permit it to excavate the streets for that purpose without the assent of the Board of Public Improvements or of the Municipal Assembly, or effort to obtain either, to the mere covenant of the company that it feared it might thereby subject itself to requirements from which it insisted it was exempt by the terms of its charter.

If the company, as it asserted, possessed the right to place electric wires beneath the surface of the streets, the court declares that right was subject to such reasonable regulations as the city deemed best to make for the public safety and convenience, and the duty rested on the company to comply with them.

If requirements were exacted or duties imposed by the ordinances, which, if enforced, would have impaired the obligations of the company's contract, this did not relieve the company from offering to do those things which it was lawfully bound to do.

The exemption of the company from requirements inconsistent with its charter could not operate to relieve it from submitting itself to such police regulations as the city might lawfully impose.

And until it had complied, or offered to comply, with regulations to which it was bound to conform, it was not in a position to assert that its charter rights were invaded, because of other regulations which, though applicable to other companies, it contended would be invalid if applied to it.

National Electric Light Convention, Chicago, June 7th, 8th and 9th.

The most popular line from Cincinnati, Louisville and all points South to Chicago is the Big Four Route via Indianapolis; magnificent sleeping cars and unequaled dining-car service. For maps, rates, etc., address E. O. McCormick, passenger traffic manager, Big Four Route, Cincinnati, O.

CORRESPONDENCE.

New York Notes.

New York, May 23.—The tedious negotiations between the Rapid Transit Commssion and the Manhattan Railway company are still in the air; the correspondence has led to no definite conclusion. The Manhattan directors express their willingness to accept six out of the seven franchises offered to them, provided the terms of compensation are readjusted to meet their approval and that "other necessary modifications" are made. The Rapid Transit commissioners regard this proposition as vague and entirely unsatisfactory. Mr. Orr, their president, in the latest letter to Mr. George J. Gould, expresses their position as follows: "The board made a definite proposition to your company, containing all necessary engineering and legal details, when it tendered to you the seven franchises referred to in our earlier correspondence. This tender has been absolutely refused by you as regards the Seventh or Amsterdam avenue franchise. But your letter seems to imply a willingness to accept the remaining six franchises, provided the compensation be readjusted, the time of construction be left indefinite, and subject, as you write, to certain 'other necessary modifications.' The board cannot act upon a proposition so vague, nor will it, in any event, grant a mere option to occupy the streets. But if you will comply with the request contained in my letter of the 13th inst., and will amend the text of the six franchises already tendered to you in such manner as to obviate the indefiniteness of your letter and to show (excluding only the question of compensation) exactly what contract you are willing to make with the city, the board will at once consider your counter-proposition, and will discuss with you the question of compensation with an unbiased mind, in the desire of reaching some solution which will be fair to you and of benefit to the city. But unless your company is willing, in the reasonable manner thus suggested, to submit to our board a counter-proposition which shall be complete in all its details, and which shall thus show exactly what benefit the community may expect to receive from your action, it would appear to be futile to continue the negotiation." M. S.

PERSONAL

Mr. Hugo Diemer, formerly of Diemer & Hebble, Cincinnati, has accepted a position with the Westinghouse Electric and Manufacturing company at Atlanta, Ga.

W. R. Mason, representative of the Walker company at St. Louis, was in Chicago early in the week. Mr. Mason has two years in the naval reserve force that has just left Chicago for the front.

Ben Williams, one of the leading life-insurance men in Chicago, with a wide acquaintance among electrical men, died last week. Mr. Williams was a member of the old Chicago Electric Club and at one time was active in its affairs. He was a man of many friends, and his death is keenly regretted.

Dr. H. S. Carhart, the professor of electrical engineering in the University of Michigan, was a visitor in Chicago early in the week. Professor Carhart states that the patriotic spirit is high at the university. Two professors and about 100 students have left their books to serve in the army or navy, and several companies are drilling at home.

ELECTRICAL SECURITIES.

The Nassau Electric Railroad company has improved its condition materially since the first of the year. During that period the gross earnings were $419,378, an increase of $84,833 over the corresponding period of last year.

The Brooklyn Heights Railroad company's report for the quarter ended March 31st shows gross earnings of $1,058,169, an increase of $68,466, and operating expenses $697,710. The net earnings were $360,459, an increase of $15,704. The company's business has steadily improved since July 1st, the surplus being increased $43,543 in that time.

The Edison Electric Illuminating company of New York reports gross earnings for April of $260,609, an increase of $54,466 as compared with the

same month of last year, and net $120,796, an increase of $19,952. For the four months ended April 30th, the gross earnings were $1,079,772, an increase of $212,656 as compared with the corresponding period of last year, and net $498,983, an increase of $73,168.

MISCELLANEOUS.

"Useful Information for Practical People" is the attractive title of a vest-pocket book issued by Foree Bain of Chicago. It contains practical hints and valuable data in concise form which can be readily understood by the layman as well as the engineer, and there is a good deal of useful information for those not engaged in engineering occupations.

The United States consul at St. Gall reports that in the following-named cities in the German Empire the municipal authorities own and manage the electric works that supply light and power: Bremen, Barmen, Cassel, Darmstadt, Düsseldorf, Elberfeld, Hanover, Cologne, Königsburg, Lübeck and Pforzheim. All of these cities, with the exception of Hanover, also own the gas-works. The following-named cities have constructed electric works for the purpose of furnishing light and power, but have leased them to private operators: Aix-la-Chapelle, Chemnitz, Frankfort, Strasburg and Stuttgart, all of which, with the exception of Chemnitz, are cities where the gas-works are under the management of private corporations. In the following-named cities private companies have established electric works with the agreement that, under certain conditions, the municipal authorities shall have the privilege of securing absolute control and ownership by purchase: Altona, Dessau, Gera, Hagen, Heilbronn, Leipsic, Mülhausen, Stettin and Zwickau. Of these cities, the gas-works are under private control in Dessau, Hagen, Mülhausen and Zwickau.

TRADE NEWS.

Sipe & Sigler of Cleveland have received orders for Willard batteries from the Riker Electric Motor company of New York, and the Fischer Equipment company of Chicago for motor vehicles sold in Paris.

The American Telephone and Telegraph company has issued a "war atlas" which contains some excellent maps of the localities affected by the present trouble between Spain and this country.

The Buckeye Electric company finds its capacity unequal to the demand for the Buckeye double-anchored filament 220-volt lamp. Additional apparatus is being placed to meet the requirements. Consumers express satisfaction over the sustained candle power of this lamp.

The American Tool Works company of Cincinnati, Ohio, has received, through its office at London, England, orders from Wimhurst, Hollick & Co. of London, amounting to $12,000, including engine lathes from 14 to 22 inches swing, planers, radial drills, upright drills, bolt cutters, milling machines and chucking lathes; also an order from Pearson, Bennin & Co. of Leicester, England, for a number of engine lathes and upright drill presses.

Automatic telephone pay stations for the independent-telephone field have been put on the market by the Mason Telephone Pay Station company of Ludington, Mich. The instruments are said to be giving entire satisfaction. The Mason company will ship an instrument on 30 days' trial to any responsible telephone company, and if not found satisfactory, it may be returned at the Mason company's expense. Full particulars will be cheerfully sent on request.

The Centralia (Ill.) Coal and Mining company has purchased, through G. P. Nichols & Bro. of Chicago, the western agents of the Jeffrey Manufacturing company of Columbus, a complete electrical outfit for coal mining, consisting of five standard electrical chain breast coal-mining machines, one 10-ton electric locomotive of 30-inch gauge, three electric drills, one 250-volt 120 kilowatt generator, and a 200 horse power engine. It is said that the electric mining locomotive of the Centralia company will be the first to be put into service in this state.

BUSINESS.

The American Stoker company, Washington Life building, New York, announces a new catalogue, which will be sent to anyone desiring a copy.

The Jandus Electric company's enclosed alternating arc lamp is said to be a trade-getter for central stations. Several instances have developed, where non-users of electric light have been brought into line by the splendid illuminating power and all-around serviceability of this lamp. The trade adjacent to Chicago is supplied with catalogue, price, etc., on application to 753 Monadnock building, Chicago.

The Automatic Switch company of Baltimore, Md., manufacturer of automatic starting apparatus for pumps, elevators, etc., has appointed the following-named agents: For New York city and New Jersey, D. H. Darrin, Vanderbilt building, New York; for Michigan, Wisconsin, Illinois, Indiana and Iowa, Harding & Hammer, Marquette building, Chicago; for Louisiana, Vincent Gray, New Orleans.

Barber shop, bath, ladies' maid, stock reports, stenographer and typewriter, and other distinctive features originated on the Pennsylvania Short Lines are retained on the New Pennsylvania Limited which leaves Chicago 5:30 p. m. daily over that route for New York. The new service possesses every possible improvement. For full information address H. R. Dering, assistant general passenger agent, 248 South Clark street, Chicago.

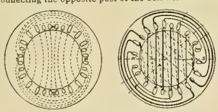
The Electric Appliance company has recently concluded the general distribution of its fan catalogue for the season of 1898. In sending out catalogues to a large list of buyers, it is often the case that some are overlooked. The Electric Appliance company would be pleased to hear from any consumer who has not received a copy of this handsome catalogue, as it is anxious to place the catalogue in the hands of every possible user or purchaser of fan motors.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued May 17, 1898

604,033. Electrical Safe Protection System. Isaac Freed, Harrisburg, Pa. Application filed June 15, 1897.

A safe is provided with two contact points, a conductor extending from one point to the other point and including one or more switches, the bottom and the closed circuit embracing the spring fingers and the switch in combination with the alarm box, the magnet core and its armature forming a part of the closed circuit, the battery and conductor connected to the armature, the contact screw, located in the path of the armature, the switch, the conductor connecting switch and screw, the alarm bell, the conductor connecting one post of switch and bell, and the conductor connecting the opposite post of the bell with the battery.



NO. 604,055.

604,055. Electromagnet Having Rotating Fields. Walter Langdon-Davies, London, England. Application filed May 23, 1896.

A field magnet for an electric motor or transformer is described consisting of a substantially cylindrical magnetic core, wound with coils of wire encircling varying amounts of the cylindrical field space, the coils being distributed upon the cylinder in due proportion to the magnetic reluctance to be overcome in the central field space, so as to produce a field of substantially uniform density.

604,081. Electric-lighting System for Railway Cars. Willard F. Richards, Buffalo, N. Y. Application filed September 16, 1897.

The driving axle is provided with a pulley; the dynamo is provided with a pulley and capable of movement toward and from the driving axle in a substantially horizontal direction, and a driving belt is applied to the pulleys; a pressure device is attached to the car and presses the dynamo away from the driving axle, whereby the pressure is applied to the belt for producing the desired normal speed of the dynamo shaft irrespective of the weight of the dynamo, while the latter is moved toward the axle when the speed increases above that which produces the desired normal speed of the dynamo, causing a slip of the belt which neutralizes the excess of speed of the axle.

604,082. Electric-lighting System for Railway Cars. Willard F. Richards, Buffalo, N. Y. Application filed September 22, 1897.

The dynamo is provided with a pulley, and a driving belt is applied to pulleys; a fluid-pressure mechanism is connected with the movable dynamo and is pressed away from the driving axle to tighten the belt, while the dynamo is drawn toward the axle by an excessive speed of the belt.

604,083. Electric lighting Apparatus for Railroad Cars. Willard F. Richards, Buffalo, N. Y. Application filed September 25, 1897.

Claim is made for the combination with a car body, a car truck and its axle, and a dynamo driven from the axle, of a support on the car body by which the dynamo is carried and which permits of the lateral movement of the dynamo with reference to the car body, and a connection from the dynamo to the car truck by which the dynamo is caused to remain in alignment with the car axle.

604,084. Electric-lighting Apparatus for Railway Cars. Willard F. Richards, Buffalo, N. Y. Application filed October 11, 1897.

One claim is given: The combination with the car body and a car axle of a longitudinal track or way arranged on the under side of the car body, a carriage mounted on the track and carrying a dynamo, a horizontal socket mounted on the carriage, a tubular follower applied to the socket, a tension spring arranged in the socket and follower, an adjusting screw engaging with the follower, and an upright operating shaft geared with the adjusting screw.

604,085. Electric-lighting Apparatus for Railway Cars. Willard F. Richards, Buffalo, N. Y. Application filed October 14, 1897.

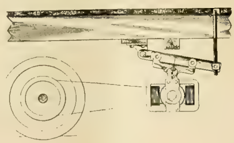
The combination is claimed with a railway vehicle and its axle of a longitudinal track or way arranged on the under side of the vehicle, a dynamo mounted on the track and capable of moving toward and from the car axle, a frictional driving mechanism whereby the dynamo is driven from the car axle, a horizontal cylinder supported by the vehicle, a piston arranged in the cylinder and connected with the dynamo, and means for delivering fluid under pressure to the cylinder.

604,094. Telephone-switchboard Plug. James Taylor, Heathercliffe Helsby, England. Application filed November 21, 1896.

This device comprises a metal bolt having a head at one end with an insulating sleeve, and having one end enlarged to form a washer lying adjacent to the head of the bolt, a metal sleeve on the insulating sleeve being provided with a collar at one end lying adjacent to the washer of the insulating sleeve and having a tongue at the opposite end, an insulating ring or washer on the metal sleeve adjacent to the collar thereof, a second metal tube forming the body of the plug having one end smaller than the other, a second insulating sleeve on the second metal tube, one portion of the latter sleeve fitting within the smaller portion of the second metal tube, and the other portion fitting in the larger part of the latter tube, an insulating washer on the smaller end of the second insulating sleeve and a nut on the bolt to secure the various parts thereon, and an insulating casing secured to the body of the plug.

604,098. Rail Conductor for Electric Systems. Louis E. Walkins, Springfield, Mass. Application filed August 18, 1897.

The combination is described of several rails in end-to-end arrangement, an intermediate one consisting of two opposite longitudinally ranging metallic sections and an intermediate rail of non-conducting material supporting and insulating the sections, end portions of the intermediate rail overlying the ends of the metallic sections and serving to insulate the respective metallic side sections at their ends from the rails adjoining the ends of the intermediate sectional rail.



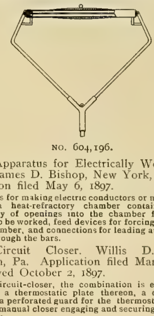
NO. 604,101.

604,101. Electric-lighting Apparatus for Cars. Edward Wilhelm and Willard F. Richards, Buffalo, N. Y. Application filed October 23, 1897.

An inclined track or way is arranged on the under side of the vehicle, a dynamo is supported on the track and capable of moving thereon toward and from the axle, and a frictional driving mechanism whereby the dynamo is driven from the axle.

604,128. Electrical Apparatus for Operating Elevator Doors. Humphrey R. Smith, Chicago, Ill. Application filed April 14, 1897.

The arrangement comprises the following features: A motor comprising a sectional solenoid, a movable core therefor, a circuit for the coils of the solenoid, the circuit controllable from the car and means for successively cutting out of the circuit and for progressively cutting into the circuit certain of the sections or coils, the means actuated by the movements of the core in combination with a door and connections between the door and core.



NO. 604,196.

604,137. Apparatus for Electrically Working Metals. James D. Bishop, New York, N. Y. Application filed May 6, 1897.

Means for making electric conductors or metal wire comprise a heat-refractory chamber containing a die, a plurality of openings into the chamber for bars of the metal to be worked, feed devices for forcing the bars into the chamber, and connections for leading an electric current through the bars.

604,157. Circuit Closer. Willis D. Kennedy, Easton, Pa. Application filed March 25, 1895. Renewed October 2, 1897.

In a circuit-closer, the combination is effected with a base of a thermostatic plate thereon, a central manual closer, a perforated guard for the thermostat, and a cap for the manual closer engaging and securing the guard on the base.

604,196. Trolley for Electric Railways. Sidney H. Short, Cleveland, Ohio. Application filed September 26, 1896.

The cut shows a familiar form and the claims contain the following: The combination of a motor car and an overhead conductor, with a trolley arm mounted on the car by means which permit the vertical movement but prevent the lateral movement of the upper end of the trolley arm, a horizontal cylindrical roller mounted on the upper end of said trolley arm and a convex sleeve secured upon said roller between its ends.

604,219. Electric Arc Lamp. Frank W. Steinacker and Edwin F. Cowley, Cleveland, Ohio. Application filed April 12, 1897.

In the construction of this lamp there are employed a stationary tube, a clutch below the same, a movable tube adapted to stand within the stationary tube and adapted to project downward beyond the clutch while in engagement with the stationary tube, the movable tube contacting with the stationary tube and receiving current from it and a movable carbon carried by the movable tube.

604,258. Apparatus for Joining Telegraph Cables. Henri Menier, Paris, France. Application filed December 28, 1897. Patented in France May 11, 1897.

The apparatus described for completing telegraphic cable joints comprises an elastic cylinder to inclose the cable joint, hollow chambers about the cylinder and means for admitting fluid pressure to the chambers to compress the cable joint.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, JUNE 4, 1898. No. 23

President Samuel Insull.

The presiding officer of the twenty-first convention of the National Electric Light association, which will be held in this city next week, will be Mr. Samuel Insull, who was elected to the presidency of the organization at the Niagara Falls gathering in June last year. An excellent portrait of President Insull, reproduced from a recent photograph, adorns this page. His features are familiar to the electrical fraternity, in spite of his aversion to all kinds of publicity, owing to the conspicuous position he has occupied in the electrical manufacturing and central-station business of the country. For many years he was closely identified with Mr. Edison and looked after the latter's commercial interests, relieving him of business cares and permitting him to devote his entire attention to the experimental work in which he was engaged.

Mr. Insull was born in London on November 11, 1859, and came to this country in March, 1881. He had been actively engaged in promoting Mr. Edison's European interests before coming to the United States, especialy in the field ot telephony, and in this work had been associated with Edward H. Johnson of New York, through whose solicitation Mr. Insull came to this country to act as private secretary for Mr. Edison. Mr. Insull found Mr. Edison completely occupied with experimental work that ultimately resulted in the development of the central-station system which bears the great inventor's name.

When Mr. Edison had succeeded in producing a commercial lamp and had designed generating apparatus and the necessary fixtures for utilizing them, it was determined to organize a manufacturing business to produce the necessary equipment. This task was assigned to Mr. Insull, although he was then without experience in manufacturing business of any kind. The Edison shops comprised three or four enterprises which Mr. Edison controlled and were conducted under the personal supervision of Mr. Insull. The business prospered, and it was soon found necessary to make provision for larger works. This led to the establishment of the Schenectady works, which were opened on Christmas Day in 1886. They were built during Mr. Insull's administration, and were run by him until the organization of the Edison General Electric company. In the formation of that concern Mr. Insull was made second vice president. He was placed in charge of the manufacturing department, and afterwards was given charge of the selling department also, thus placing him in absolute control of the company, aside from the financiering of the institution. When the Edison General Electric company was consolidated with the Thomson-Houston interests in the General Electric company Mr. Insull was elected second vice-president, but he immediately resigned, and really had no part in the management of that corporation.

Upon his retirement from the manufacturing business Mr. Insull entered the central-station field. He accepted the presidency of the Chicago Edison company, and has since directed the affairs of that corporation. Its development has been as remarkable as the other enterprises with which he has been identified. It might be mentioned that the Chicago Edison company holds a perpetual license from the Edison Electric Light company of New York to use its patents in Cook county, Ill. Its principal station on Harrison street, where the greater portion of its output of electrical current is manufactured, is one of the most complete in the United States. It has three other central stations. During Mr. Insull's management the company has made numerous additions and extensions. His aim has been to secure as nearly as possible complete control of the electric-lighting business of the city. With this purpose he consummated the absorption of the Chicago Arc Light and Power company, the Chicago Illuminating company and several smaller concerns that had been operating in the same territory as the Chicago Edison company. He also secured control of the companies that supplied current outside the "Edison district" and thus secured immunity from competition. The Hyde Park Thomson-Houston company was purchased by interests friendly to the Edison company, and Mr. Insull became president. In November, 1897, the capital stock of the Englewood Electric Light company was purchased in the same interest and Mr. Insull became the president of that company. About the same time the Western Light and Power company, having a 1,200 horse power plant and an extensive lighting business in Lake View, was purchased by interests friendly to the Edison company. The West Side Electric Light and Power company and several other small concerns were added to the list of companies controlled by the Chicago Edison company and friendly interests. It was deemed advisable to organize the outside companies into one concern, and accordingly they were consolidated under the name of the Commonwealth Electric company and will be operated under the franchise bearing that name. This consolidation, which secures harmony in the operation of the electric-lighting interests of Chicago, was brought about by Mr. Insull, and is deservedly considered a notable achievement in the electrical and financial world.

PRESIDENT SAMUEL INSULL

Mr. Insull is interested in several other enterprises, but these do not occupy much of his attention. He has given a great deal of time and thought to the National Electric Light association since his election to the presidency and has done much to remove the friction that formerly was noticeable between the Edison interests throughout the country and the companies employing other types of apparatus.

Mr. Insull is a firm believer in everything that bears the name of Edison, and he has been a powerful factor in the Association of Edison Illuminating Companies, of which he is now the president. The Edison companies of the country, it may be mentioned, are formed upon the same general plan, and their conventions are more in the nature of family conferences than anything else. Their sessions are held behind closed doors, and business matters of considerable importance are freely discussed there.

It will be understood at once that the objects and scopes of the National and the Edison associations are entirely different, and there seems to be no reason why they should conflict, yet it is known that they have not worked in harmony heretofore, and President Insull has striven to remove all such differences during his administration.

Mr. Insull is a member of several other organizations, including the Chicago club and the Fellowship club. He is also a member of the Institution of Electrical Engineers of London, and frequently visits his old home. He is, however, thoroughly American, and it may be added, that he is the personification of Chicago enterprise and persistence. His remarkable success is no doubt largely due to these characteristics in combination with a rare executive ability and knowledge of men.

Mr. Insull's loyalty to Mr. Edison and his deep admiration for and confidence in the ability of the great inventor have often been remarked by those who are familiar with him. It is true, too, that Mr. Edison entertains a high opinion of Mr. Insull's ability and fully appreciates the value of the services rendered him when careful management and close attention to the details of the Edison business were mostly needed. The uninterrupted friendship which has existed for so many years between these men is often the subject of comment among those who are familiar with their personal traits. Two more dissimilar characters could hardly be imagined, yet they thoroughly understood and appreciated each other, and Mr. Insull attributes much of his success to Mr. Edison and the opportunities that came to him because of their friendship

NATIONAL ELECTRIC LIGHT ASSOCIATION.

For the third time in the history of the National Electric Light association the convention of that organization will be held in Chicago on June 7th, 8th and 9th. In a measure the association may be considered a Chicago institution, as the principal promoters of the movement that eventually resulted in its formation were identified with the electrical interests of this city, the preliminary meetings were held here and the organization was finally perfected at the convention held in this city on February 25 and 26, 1885. This was the first formal gathering of the new association.

The next time the members honored Chicago by assembling in this city was in February, 1889. On that occasion the meeting was held at the old Exposition on the lake front, which has since been removed to make way for the beautiful home of the Art Institute. The second Chicago meeting was the most successful electrical gathering that had ever been held, and the exhibition of electrical apparatus of all descriptions that was made in connection with the convention was largely attended and served to attract public attention to the multifarious duties which electricity was prepared to perform.

Those who attended the early meetings of the association will probably be interested in making comparison with this year's gathering. It will be found that the association reflects in its annual conventions the changes that have taken place in the business. The "boom" days have been succeeded by a period of conservative tendency. The electric-lighting business to-day is conducted on strictly commercial lines, and its representative organization is simply a gathering of technical and commercial experts of the industry.

The convention headquarters of the association will be at the Auditorium, and the meetings will be held in the banqueting hall. Following is the official programme for the convention:

TUESDAY, JUNE 7, 1898.

Meeting of the executive committee at 9 a. m., secretary's office, Auditorium Hotel.

Morning Session, 10:30 O'Clock.

Address: President Insull.

Paper: "Cost of the Generation and Distribution of a Unit of Electricity," by Calvin W. Rice, Brooklyn, N. Y.

Topic: "Prices and Discounts for Electric Current and Methods of Billing Current to Customers."

Afternoon Session, 2 O'Clock

Paper: "Public Lighting with Relation to Public Ownership or Control," by Alex Dow, Detroit, Mich.

Topic: "Legislative Policy as to Public-service Corporations."

WEDNESDAY, JUNE 8, 1898.

Morning Session, 10 O'Clock.

Paper: "General Distribution from Central Stations by Alternating Currents," by Herbert A. Wagner, St. Louis, Mo.

Paper: "General Distribution from Central Stations by Direct Currents," by Louis A. Ferguson, Chicago, Ill.

Topic: "Standardizing Apparatus for Central-station Use."

Afternoon Session, 2:30 O'Clock.

Paper: "Cost of Producing Electric Power by Water Power from Lachine Rapids, Canada," by W. McLea Walbank, Montreal, Canada.

Report of committee on "Standard Candle Power of Incandescent Lamps," by Dr. Louis Bell, chairman.

Questions and answers. What is it you wish to know?

Executive session.

Evening Session, 8 O'Clock.

Lecture: "Electricity Direct from Coal" (Illustrated with stereopticon), by Joseph Wetzler, New York.

THURSDAY, JUNE 9, 1898.

Morning Session, 10 O'Clock.

Paper: "Transformer Economy," by Professor Winder Elwell Goldsborough, Purdue University, Lafayette, Ind.

Report of committee on "Amendments to Freight Classification," by James J. Ayer, chairman.

Report of committee on "Legislation Concerning Theft of Current," by James J. Ayer, chairman.

Afternoon Session, 2:30 O'Clock.

Topic: "Freight Rates on Electrical Apparatus."

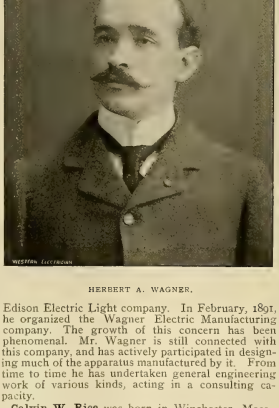
Report of committee on finance, by John A. Seeley, chairman.

Executive session.

Election of officers.

Portraits, accompanied by brief biographical sketches of the gentlemen who will read papers during the convention are herewith presented. It should be mentioned that Mr. Ferguson, who will contribute a paper on the subject of "General Distribution from Central Stations by Direct Currents," has taken a prominent part in the arrangements for the reception and entertainment of convention visitors, and his portrait and biographical sketch are presented with other members of the local committee.

Herbert A. Wagner was born in Philadelphia on February 24, 1867. He received his education at Stevens Institute of Technology, where he was graduated as mechanical and electrical engineer in June, 1887. He entered the service of the Westinghouse Electric and Manufacturing company at Pittsburg in September, 1887, and after spending about a month in the Pittsburg factories was sent West by the company to supervise the installation of electric-light plants in a number of western cities. This experience proved valuable to him when he was sent to St. Louis in the summer of 1888 to assist in the organization of an electric-light company, which was to purchase apparatus from the Westinghouse company. As a result the Missouri Electric Light and Power company was incorporated in 1889, and work was at once begun on the installation of a large central station under his supervision. In 1890 he withdrew from the Westinghouse company to enter the service of the local central-station company as general superintendent. He has retained this position throughout the different reorganizations and consolidations of the local companies, which finally resulted in the incorporation of the Missouri-



HERBERT A. WAGNER.

Edison Electric Light company. In February, 1891, he organized the Wagner Electric Manufacturing company. The growth of this concern has been phenomenal. Mr. Wagner is still connected with this company, and has actively participated in designing much of the apparatus manufactured by it. From time to time he has undertaken general engineering work of various kinds, acting in a consulting capacity.

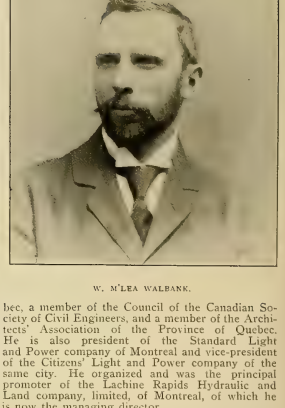
Calvin W. Rice was born in Winchester, Mass., a suburb of Boston. After graduating in the course of electrical engineering from the Massachusetts Institute of Technology, he entered the Lynn works of the Thomson-Houston Electric company, and in four years was advanced to the position of assistant engineer of the motor department. At the time of the consolidation of the Thomson-Houston Electric company and the Edison General Electric company, he was made assistant engineer of the power and mining department of the General Electric company. From Schenectady he was transferred to the more responsible position of district engineer at Cincinnati, O. From 1895 to the beginning of the present year Mr. Rice has been engaged as consulting engineer on long-distance transmission propositions for lighting and power in Colorado and Montana.

Last year, in trips aggregating over 20,000 miles, he completed a tour of visitation to all the principal electric plants in the United States and many in Canada.

He is now electrician of the Kings County Electric Light and Power company of Brooklyn, of which A. M. Young is general manager and E. F. Peck superintendent.

Alex Dow was born in Glasgow, Scotland, in 1852, and was educated in the public schools. He was employed in railroad and steamship offices in Scotland, England and the United States from 1874 until 1883, and then held a position with the Baltimore and Ohio Telegraph company until 1887, first in office work and afterwards in charge of city lines in Baltimore. Then for a year he was engaged with central stations and construction companies as lineman, wireman and general utility man. From October, 1888, until June, 1893, he was employed by the Brush Electric company, having charge of the expert and engineering work at the Chicago office of that company. During that period he was an occasional contributor to the Western Electrician and took a prominent part in the discussions at the Chicago Electric club. In July, 1893, he was appointed electrical engineer of the Public Lighting Commission of Detroit, and for three years occupied that position, that period covering the construction and the first 15 months of operation of the city lighting plant. For the last two years he has been general manager of the Edison Illuminating company of Detroit, and has also carried on a business as a consulting engineer. Mr. Dow is a member of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers and a vice-president of the Detroit Engineering society.

W. McLea Walbank was born in St. Johns, Newfoundland, and was graduated in applied science in the department of civil and mechanical engineering, McGill University, Montreal, in 1877. He was admitted to the practice of provincial land surveying for the province of Quebec in 1878, and has since been identified with that profession. He was a member of the Canadian Society of Civil Engineers at its formation in 1887, and is now president of the Provincial Land Surveyors of the Province of Que-



W. M'LEA WALBANK.

bec, a member of the Council of the Canadian Society of Civil Engineers, and a member of the Architects' Association of the Province of Quebec. He is also president of the Standard Light and Power company of Montreal and vice-president of the Citizens' Light and Power company of the same city. He organized and was the principal promoter of the Lachine Rapids Hydraulic and Land company, limited, of Montreal, of which he is now the managing director.

Joseph Wetzler was born at Hoboken, N. J., December 6, 1863, and received his early education at the Hoboken Academy, where he graduated at the head of his class. Mr. Wetzler entered the Stevens Institute of Technology, where he pursued the four years' course, and took the degree of mechanical engineer in 1882. He entered the works of Edward Weston at Newark, N. J., and gained much practical experience, after which he was engaged for a short term on the editorial staff of the Scientific American, and then assumed the editorship of the Electrical World. In April, 1890, he took the editorial management of the Electrical Engineer. Mr. Wetzler is the joint author with T. C. Martin of "The Electric Motor and Its Applications," a pioneer work, which has already passed through numerous editions. With Mr. Martin he also assumed in 1891 the editorship of the electrical section of the new edition of Appleton's "American Cyclopædia of Applied Mechanics." To Scribner's Magazine he contributed the electric-railway article in the series since published in book form.

Mr. Wetzler has always been interested in educational work, and his latest effort has resulted in the formation of the Electrical Engineer Institute of Correspondence Instruction, of which he is the president.

Mr. Wetzler was one of the earliest members of the American Institute of Electrical Engineers, has

been an active member of its council for several years, and also occupied the office of vice-president. He was a delegate from that body to the Paris Electrical Congress of 1889. For many years he acted as secretary of the New York Electrical society, then became its vice-president and finally its president. Mr. Wetzler has also been a vice-president of the Stevens Institute Alumni association and is a member of the American Association for the Advancement of Science, the London Institution of Electrical Engineers and the Vienna Elektrotechnische Verein.

In the intervals of his professional work, and as an aid to it, Mr. Wetzler has found time to cultivate languages, and, besides being thoroughly conversant with English, German and French, has a useful knowledge of Spanish and Italian.

Winder Elwell Goldsborough is the director of the School of Electrical Engineering at Purdue University, Lafayette, Ind. He has been actively engaged in electrical work for six years, having graduated from the mechanical engineering department of Cornell University in 1892, and immediately thereafter accepted the position of electrical engineer to the Colliery Engineer company of Scranton, Pa., which he resigned to accept a call to the Arkansas University. There he pushed the development of the electrical laboratories and the course in electrical engineering.

Mr. Goldsborough was called to Purdue University in the capacity of associate professor of electrical engineering in 1894, and was appointed to the directorship of the School of Electrical Engineering in 1896. His connection with the commercial interests of the country has been chiefly in the capacity of advisory engineer in conducting economy tests and in designing plant equipments. Under his direction efficiency tests have been conducted on the electric mining plants of Brazil, Ind., the municipal plant of Logansport, Ind., the plant of the Edison Electric Illuminating company of Baltimore and numerous others.

Professor Goldsborough is a member of the American Association for the Advancement of Science, the American Institute of Electrical Engineers, the Society for the Promotion of Engineering Education, the Society of Mechanical Engineers and the Indiana Academy of Science. He is the author of a number of scientific papers and has traveled in Europe and the far East. His latest contribution to electrical literature was a paper before the American Institute of Electrical Engineers on April 27th, entitled "An Economy Test of a Central Station," giving the result of his study of the Baltimore plant in 1895. It was a very comprehensive paper and attracted considerable attention.

Officers of the Association.

The present officers of the association are: President, Samuel Insull, Chicago, Ill.; first vice-president, A. M. Young, Waterbury, Conn.; second

WINDER ELWELL GOLDSBOROUGH.

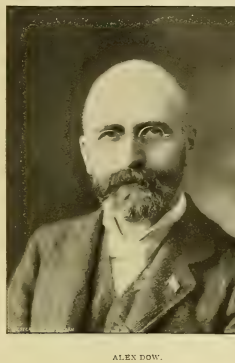
vice-president, George R. Stetson, New Bedford, Mass.; secretary and treasurer, George P. Porter, New York; master of transportation, C. O. Baker, Jr., Newark; executive committee: W. R. Gardener, G. A. Redman, H. A. Wagner, John A. Seely, A. J. DeCamp, E. H. Stevens, F. A. Gilbert, W. W. Dean and W. McLee Walbank.

The craze for automobile vehicles is reported to have reached a high pitch in Paris. Automobile carriages and tricycles are to be seen everywhere in the streets of that city, and the supply falls so far short of the demand that prices have gone up materially. The best makes are said to have more orders on their hands than they can fill in two years.

Entertainment of Visitors.

The local electrical interests will provide entertainment for the visitors, and special attention has been given the arrangements for the ladies who will accompany the delegates. The principal feature of this programme is a reception at the Auditorium Hotel, Monday evening, from 8 o'clock to 10:30. Wednesday evening will be occupied with a popular lecture by Joseph Wetzler of New York on "Electricity Direct from Coal." The coaching parties arranged for the ladies during the day, when the men will be engaged in the sessions of the convention, will no doubt prove a very attractive feature of the entertainment.

The following-named gentlemen, comprising rep-



ALEX DOW.

resentatives of the electrical interests of Chicago, were appointed a reception committee: C. H. Wilmerding, chairman; Samuel Insull, J. Holt Gates, J. B. O'Hara, L. A. Ferguson, J. B. Wallace, F. E. Donohoe, J. R. Wiley, M. Coster, F. B. Badt, L. K. Comstock, Charles Munson, M. J. Insull, F. W. Kohler, W. A. Kreidler, W. H. McKinlock, G. A. McKinlock, B. E. Sunny, W. W. Low, F. H. Clark, F. S. Gorton, E. B. Kittle, George C. Bailey, A. S. Hibbard, James Wolff, H. R. Hixson.

From this committee a sub-committee of five, to be known as the entertainment committee, was selected to make the necessary arrangements for the meeting. This committee is composed of Messrs. Wilmerding, Sunny, Ferguson, Wallace and Coster, and they have certainly acquitted themselves creditably. Brief sketches of these gentlemen, whose portraits are herewith presented, are appended:

C. H. Wilmerding, chairman of the reception committee and also of the entertainment committee, is an ex-president of the National Electric Light association and has long been identified with the work of the organization. He made an excellent record as executive officer of the association, and it was during his administration that the first electrical show was organized in New York. He was also president of the Illinois state association of central-station companies formed in this city several years ago. Mr. Wilmerding is 40 years of age, a native of New York, an engineer by profession, but he has had valuable executive experience in central-station management and in commercial work. He was for many years connected with the Chicago Arc Light and Power company and the Chicago Edison company, and is now engaged in engineering work and selling agent for the Crocker-Wheeler company in the West. A biographical sketch of Mr. Wilmerding will be found in the Western Electrician of May 9, 1896.

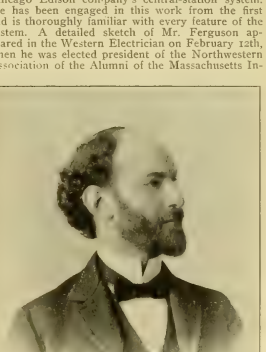
As chairman of the entertainment committee Mr. Wilmerding has had charge of the arrangements for the reception and entertainment of the visitors during the convention, and it will not be necessary to give any further assurance that the preparations for the social features are all that could be desired.

B. E. Sunny, manager of the Chicago office of the General Electric company, will be remembered by the members of the National Electric Light association who attended the last meeting in Chicago in February, 1889, as he was chairman of the executive committee which had charge of the arrangements for that successful meeting. Mr. Sunny was then identified with the old Thomson-Houston company and he was also president of the Chicago Arc Light and Power company. Both of those corporations have since been absorbed, the latter by the Chicago Edison company and the former by the General Electric company.

Mr. Sunny's experience extends to every branch of the electrical business. He began life as a telegraph operator in New York, and, after three years' experience, removed to Chicago in 1875, where he secured a position with the old Atlantic and Pacific Telegraph company. The following year he was promoted to the position of night manager, and his ability and industry soon won further promotion. In 1877 he was appointed manager of the Chicago office, and continued in that position until the Atlantic and Pacific company became a part of the system of the Western Union Telegraph company in 1879, when he became superintendent of the operating department of the Bell Telephone company's exchange in Chicago. When the contest between the Bell and Edison companies ended in a victory for the former, in 1881, Mr. Sunny was continued as superintendent of the operating department of the consolidated companies, and five years later was also given direction of the construction department. On January 1, 1888, Mr. Sunny was elected president of the Arc Light and Power company of Chicago. He was appointed manager of the Thomson-Houston company on December 1, 1888. He has also been closely identified with the electric railway developments of Chicago and vicinity. During the life of the Chicago Electric club, Mr. Sunny was an active and influential member and held several offices in the organization, contributing largely to the valuable work performed by that society. He was also prominently identified with the electrical work at the World's Fair. He served one term as a member of the local directory and was a member of the committee on electricity. He was one of the leaders in the movement which resulted in keeping the fair open evenings.

Mr. Sunny is a native of Brooklyn and is 41 years of age. He is a member of the Union League club of Chicago and several other organizations. He is happily married and has a pleasant home on the North Side, Chicago.

Louis A. Ferguson, general superintendent of the Chicago Edison company, represents the local central-station interests upon the entertainment committee. He has been identified with this branch of the business for 10 years, and has attained considerable prominence, especially as an authority upon the design, construction, operation and management of central stations. Mr. Ferguson is a native of Boston, 31 years of age, a graduate of the Massachusetts Institute of Technology (class of '88), and is president of the Northwestern Alumni association of that institution. He is also a member of the Technical club of Chicago and during the life of the Chicago Electric club was an active member of that body. Mr. Ferguson's work can best be appreciated by those who are familiar with the development of the Chicago Edison company's central-station system. He has been engaged in this work from the first and is thoroughly familiar with every feature of the system. A detailed sketch of Mr. Ferguson appeared in the Western Electrician on February 12th, when he was elected president of the Northwestern Association of the Alumni of the Massachusetts In-



JOSEPH WETZLER.

stitute of Technology upon the eve of his departure for Europe. Mr. Ferguson has had the advantage of examining the latest electrical work abroad, especially in England, where there are many ambitious enterprises under way at the present time, and in his paper on "General Distribution from Central Stations by Direct Current," which he will read at the convention next week, he will embody the latest development in this line.

Mr. Ferguson has already contributed several valuable papers to the literature of American central-station practice, the latest being his admirable summary of "Central-Station Advancement," which appeared in the Western Electrician of January 22. He was one of the staff of lecturers of the University of Wisconsin in 1895, and presented a comprehen-

address on "Electrical Engineering in Modern Central Stations," which has since been published by the university. He read a paper at the meeting of the National Electric Light association at New York on May 5, 1896, on the "Commercial Value of Acetylene Gas as an Illuminant," giving the results of his experiments, made with Messrs. Wilson and Knapp at Spray, N. C., in May, 1895, in the production of calcium carbide and acetylene gas. The paper was published as a pamphlet by order of the association, and it is now considered one of the ablest contributions on the subject. His work in connection with Dr. Louis Bell and James I. Ayer upon the preparation of a suitable specification for a standard incandescent lamp and the determination of a proper method for the commercial application of this standard, has been highly commended. The result of this work was presented in a report on "Standard Candle Power of Incandescent Lamps" submitted to the National Electric Light association at Niagara Falls, on June 10, 1897. At the convention of the Association of Edison Illuminating Companies at Niagara Falls, September 14, 1897, Mr. Ferguson submitted an important contribution on "Economy in Distribution of Electric Energy," which provoked considerable discussion among the Edison experts.

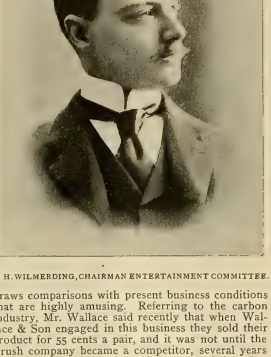
J. B. Wallace, who may be said to represent the manufacturers' agents on the entertainment committee, is a pioneer in the electric-lighting industry. As a boy he was interested in the experimental work which his uncle, William Wallace, conducted with Prof. Moses G. Farmer, at Ansonia, Conn., and it was only natural that he should continue in the same line. Mr. Wallace does not depend upon his family name for recognition by the electrical fraternity, however. One of his early achievements was the building of a telephone exchange in Waterbury in 1877, the third to be equipped in the country. It proved a successful venture and has since been developed by the Bell interests and enlarged to its present proportions. Mr. Wallace also built the first electric railway in New England. This line was owned by the Derby Street Railway company and extended to Ansonia and Birmingham. It is an interesting fact that an electric locomotive was employed upon this line to haul freight from Ansonia to the Derby docks, which is said to be the first authentic case where an electric locomotive was employed in commercial work.

Mr. Wallace was born at Ansonia, Conn., in 1858, and received his education at New Haven. As already mentioned, he manifested an interest in electrical experimental work at an early age, undoubtedly being attracted by the mystery which then surrounded the art. Moreover, his uncle, William Wallace, was a recognized authority among electrical men of the day and was a close friend of Moses G. Farmer. This naturally served to heighten the interest of young Wallace in the work,

E. E. SUNNY.

and he became associated with his father in the manufacture of electrical apparatus in 1876, when the firm of Wallace & Son was established. Among their first work was the building of the Wallace-Farmer dynamo, the historical machine which attracted so much attention at the World's Fair. The firm was the first to build dynamos, the first to light its factory electrically and the first to make carbons in this country, and, with the exception of Cornell University, the sole exhibitor of a dynamo at the Centennial in Philadelphia in 1876. It was in the factory of Wallace & Son that Mr. Edison first saw an electric light, and it was the subject of this sketch who showed it to Mr. Edison and Professor Barker of the University of Pennsylvania who were visiting William Wallace in Ansonia. It is also of historical interest that it was at this factory that Mr. Edison procured the first dynamos with which he began his now famous experiments, which eventually resulted in the development of his system of electric lighting.

In 1879 Mr. Wallace formed the Electrical Supply company, and in 1882 a Chicago branch was opened, which afterwards outgrew the original institution. Later the name was changed to the Ansonia Electric company, but in the financial crisis which swept away so many commercial institutions a few years ago the Ansonia company went down and was never revived. In the latter part of 1893 Mr. Wallace, in company with W. S. Hine, formed the Wallace Electric company in Chicago, and since then he has cultivated a large and influential acquaintance in the West. He recounts many interesting anecdotes from his early experience, and



C. H. WILMERDING, CHAIRMAN ENTERTAINMENT COMMITTEE.

draws comparisons with present business conditions that are highly amusing. Referring to the carbon industry, Mr. Wallace said recently that when Wallace & Son engaged in this business they sold their product for 55 cents a pair, and it was not until the Brush company became a competitor, several years later, that they were compelled to cut their price. The Brush people reduced the price to $142 per thousand.

Maurice Coster, manager for the Westinghouse Electric and Manufacturing company at Chicago, is another representative of the manufacturing interests on the local entertainment committee. Mr. Coster had been in Chicago only about three years, but he had been identified with electrical interests for several years previous and had a wide acquaintance throughout the country, especially among engineers, before joining the forces of the Westinghouse company 10 years ago. His experience has not been confined to this country or to one class of work. He was identified with several large projects in mechanical and mining engineering before entering the electrical field, and also had extensive knowledge of commercial development in South American and European countries. He has traveled extensively and acquired a fund of information that could not otherwise be obtained. Mr. Coster is of Holland extraction and is now in his 42d year. At the age of 16 he came to this country. He secured a scholarship at Stevens Institute of Technology, entering the sophomore class, and in 1877 was graduated with the degree of mechanical engineer. This was followed by a practical course in the machine shops of the Iowa Central Railroad company, and later at the Lake Shore railroad shops in Elkhart. His proficiency won for him the position of instructor in mechanical drawing for the Lake Shore apprentices. Mr. Coster's experience extended to every branch of the railroad business, even to firing an engine on the road. In 1879 he was induced to go to South America as engineer for a gold-mining company, but the work was not to his liking and he soon withdrew and became consulting engineer for sugar estates. He was also appointed manager of the large sugar refinery at Anna Regina, Essequibo Coast, British Guiana.

Returning to this country, he married in 1885 Miss Edith Beckell, daughter of Dr. Thomas Beckell of Albany, N. Y. Mrs. Coster did not like South America, and in the spring of 1889 Mr. Coster severed his business connections and took his wife to Europe, spending most of the time in Italy, where their first child was born in 1888. On his return to this country in October, 1888, Mr. Coster entered the engineering department of the Westinghouse company and had charge of the erection of many of the most important central-station plants installed by that company. In 1891 he was transferred to the selling department, where his engineering skill, combined with his former experience in commercial affairs, at once won promotion, and he was given charge of the Pittsburg territory. In 1895, however, Mr. Coster had the misfortune to lose his wife, and, at his request, he was transferred to Chicago on April 1st of that year. He came to this city as engineer for the Chicago office, but in January of the following year he was made manager of the Chicago district, which is one of the most important territories in the country, as it includes not only the city of Chicago, but northern Illinois and northern Indiana, Michigan, Wisconsin, Iowa, Minnesota, Nebraska, Montana and North and South Dakota. It is needless to say that Mr. Coster has made a creditable record in the management of the Chicago department and that he has gained many personal friends during his residence in this city.

Eastern Delegation.

It is expected that a large delegation from New York, Boston and other eastern points will attend next week's meeting. The passenger associations have granted the usual rate of a fare and a third, on the certificate plan, for delegates and their friends. Arrangements have been made to have the New York delegation leave the Grand Central station on Sunday, June 5th, at 1 p. m. on a special train over the New York Central, Hudson River and Michigan Central railroads. Stops will be made for passengers at Poughkeepsie at 2:43 p. m.; Albany, 4:20 p. m.; Schenectady, 5:05 p. m.; Utica, 7:03 p. m.; Syracuse, 8:35 p. m.; Rochester, 10:47 p. m.; Buffalo, 11:50 p. m. Central time; Detroit, 8:00 a. m., Monday, arriving in Chicago at 3 p. m. Monday. The train leaving Boston at 10:30 a. m. Sunday, June 5th, will connect with the New York train at Albany. In case the number of delegates attending should warrant, a special train will be run as a second section to the train named.

The Central Passenger association has granted an extension on tickets issued to members of the National Electric Light association to June 18th, so that persons holding them can go on Northwestern trip.

CONVENTION FEATURES.

The Electric Storage Battery company, through Mr. Frank H. Clark, the Chicago representative, has issued handsomely engraved invitations to the members of the National Electric Light association and others attending the convention to inspect the large new storage battery in the Edison building at 139 Adams street. A representative of the Electric Storage Battery company will take pleasure in explaining the operation of the battery to visitors. The invitation is, of course, extended through the courtesy of the Chicago Edison company, which is appreciated and acknowledged by Mr. Clark and his company. The Chicago office

LOUIS A. FERGUSON.

of the Electric Storage Battery company is at 1425 Marquette building.

The local committee of entertainment will establish a bureau of information at the Auditorium during the convention. The Chicago Telephone company kindly offered free local service and agreed to put in a long-distance instrument and furnish free service to the delegates and visitors.

S. Marsh Young, vice-president and general manager of the Manhattan General Construction company of New York, will be at the Auditorium Hotel in Chicago during the convention with a full line of the new Manhattan enclosed arc lamps. These lamps are designed to burn in multiple on circuits of from 90 to 250 volts, and two or more in series on circuits of from 200 to 600 volts, and on alternating-current circuits of from 90 to 130 volts, and any number of alternations.

Electrical and Insurance Interests.

At the time of the first meeting of the National Electric Light association in Chicago in 1885 the insurance companies looked upon the new industry as a dangerous factor, and the electric-lighting companies voted unanimously that the insurance interests were the natural enemies of progress and science. The conflicting interests continued to misunderstand each other and retard the advancement of the industry for several years, until finally an agreement was reached, and to-day they are working in harmony.

This new condition of affairs was brought about largely by the conferences between the underwriters' representatives and delegates from the several electrical and architectural organizations of the country. The credit for inaugurating the movement belongs to the National Electric Light association, and that organization also deserves praise for the energetic manner in which it engaged in the formulation and adoption of the agreement now existing between the electrical and insurance interests. It must be admitted that the latter met all these advances and displayed a desire to effect an amicable settlement.

William H. Merrill, Jr., who represented the insurance interests in these negotiations, is now the chief of the electrical bureau of the National Board of Fire Underwriters, electrician for the Western Insurance Union, covering 22 central western states and territories, and electrician for the Chicago Underwriters' association. He came to Chicago from Boston in 1893, where he had been engaged in electrical inspection work for the Boston Board of Fire Underwriters. He received his early training at the Massachusetts Institute of Technology, being a member of the class of '89. He was born in Warsaw, N. Y., in December, 1868, and is the son of W. H. Merrill, the editor of the New York World. He is the present lecturer on insurance rules at the Armour Institute of Technology and at the University of Wisconsin. He is a member of the electrical committee of the Underwriters' National Electrical association and of the National Conference of Standard Wiring Rules. The laboratory and offices of his bureau are at 157 La Salle street, Chicago. They were illustrated in the Western Electrician of April 3, 1897, and the scope and character of the work were fully described. This institution was organized through Mr. Merrill's efforts shortly after he came to Chicago, and has been built up to its present prominent position in electrical and insurance circles through his efforts. Mr. Franklin H. Wentworth, Mr. Theodore Varney, Mr. William S. Boyd and Mr. Benjamin H. Glover are associated with Mr. Merrill in this work.

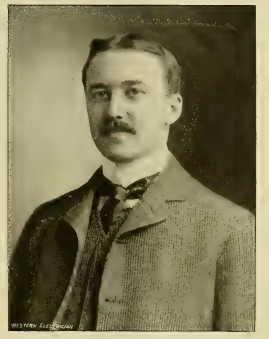
Mr. Merrill married in February of this year Miss Henderson, daughter of Mrs. C. M. Henderson, and resides at 1816 Prairie avenue. He is a member of the University and Washington Park clubs.

New York Electrical Exibition.

The show in Madison Square Garden was continued during the week, the date of closing being

I. S. WALLACE

postponed until June 4th. The attendance is said to have been large, and various novelties, including an "electrical wedding" in the Moore chapel, were prepared from day to day to appeal to the popular fancy. One incident, not down on the programme, is described in the New York Tribune of May 24th: "Thomas A. Edison, Jr., was the victim of an unintended experiment yesterday. The use of wireless telegraphy, as demonstrated in the Garden, has become a matter of comment, and its useful ness is acknowledged. While the mines in the tank have been used to blow up the miniature cruisers, another experiment has been under consideration for several days. It is that of throwing an electrical wave into the tank so that a particular mine can be exploded. The mines were placed in the tank yesterday before the show opened, and one not to be used was placed, apparently in safety, in Mr. Edison's desk, which was situated several feet from the border of the tank. Mr. Clarke, the man who sends the waves from the instrument in the gallery, was in charge of the sender, and Mr. Edison in charge of the receiver. As the wave was sent to the tank it spread, and, in spreading, caused an unlooked-for explosion, which demolished Mr. Edison's desk and destroyed many valuable papers. This startled everybody, and called for the immediate action of the fire brigade in the



WILLIAM H. MERRILL, JR.

Garden. The demonstration of the electrical wave was a most important one, and the discovery at this time of its liability to extend its radius when the full power of the wave is exerted will give Mr. Edison something to study out and Mr. Clarke something to think of."

Electrical Exhibition for Syracuse.

Among the visitors last week at the electrical exhibition in New York were General Benjamin F. Tracy, who was the guest of C. O. Baker, Jr., president of the Electrical Exhibition company, and a committee of the officers of the New York

MAURICE COSTER

State Agricultural society. The committee was received and shown through the building by President Baker and Mr. Nathan, the general manager. The object of the committee's visit was to arrange for a representation of the exhibitors in Madison Square Garden at a large electrical exhibition to be held at the State Fair at Syracuse, where there are buildings suitable for the holding of an electrical show. The generating plant in the basement of the Garden, the system of arc and incandescent lighting and many other things of the exhibition were carefully examined by the committee.

The Diffusion of Light.

It is very interesting to review the development of artificial-light producers, from the torch to the electric lamp. This development accurately marks the progress of the human race; and no one can predict how much nearer we shall approach to the ideal of artificial light—the light of the sun without the heat of the sun. The subject has attracted the attention of many lecturers and writers, among them the author of the clever verses printed below. The writer, Mr. A. A. Atkinson, is the contracting agent of the Toledo Consolidated Electric company, and he naturally glorifies the incandescent lamp. The poem, attractively illustrated, is distributed as a souvenir booklet by Mr. Atkinson's company.

THE EVOLUTION OF LIGHT.

When man dwelt in darksome forests,
Vast and lone,
And the simple, rude log cabin
Was his home;
As he sat by winter firelight's
Flickering ray,
He ne'er dreamed that in the future,
Far away,
Man would learn to turn the midnight
Into day.

But the world's in evolution,
We all know,
While the years in ceaseless cycles
Come and go;
So the need for light grew stronger,
Bit by bit;
Then evolved that rude creation,
Tallow dip,
For the want of man is mother
To his wit.

Soon another step was added,
Slow but sure,
For with time naught but perfection
Will endure;
So from out this first rude issue
Of man's power
Sprung the stately tallow candle's
Graceful tower,
As in turn from out the rosebud
Comes the flower.

But the queen, the little candle,
Fairy sprite,
Was not allotted long to rule the
Realms of night;
For from depths of old earth's bosom,
Long unseen,
Rose a king, the fiery monarch,
Kerosene,
And he ruled the night by lamplight's
Glow serene.

Yet he found a mighty rival
To his throne,
For now Gaslight claimed the kingdom
For his own;
But man found them each so royal
In their place,
That he crowned them both his sovereigns.
High in grace,
And to-day we see them shining,
Face to face.

But in rush of onward progress,
Very soon,
Man declared he wished the midnight
Like the noon;
And he said "Go chain the lightning
For my home!"
And behold! ere ceased his accents'
Fading tone
Flashed the dazzling Arc Electric's
Upturned dome.

But the climax of the wonders
Of the age,
Far surpassing wildest dreams of
Wisest sage,
Fairest rival of the sunshine
In its might,
Or a thousand stars of Heaven
Gorgeous, bright,
Is the mystic Incandescent's
Globe of light.

Illinois Street Railway Association.

The Illinois Street Railway association will meet in this city on June 7th and 8th. The headquarters of the organization during the convention will be at the Great Northern Hotel. The programme includes several important papers. C. L. Bonney of Chicago will read one on the "Rights of Street Railways under the Constitution." E. X. Lessenr of Danville will discuss the "Operation of Street Railways in Small Cities." W. L. Ferguson of Decatur has been assigned the subject of "A System of Collection of Fares and Checking Employes." D. B. Sherwood of Elgin will consider the "Relations of Street Railways and Municipal Corporations."

C. K. Minary, the secretary of the organization, has issued invitations urging all street-railway men of the state to attend the meeting.

Chicago Edison Company's Storage-battery Plant.

The latest feature of the central-station distribution system of the Chicago Edison company is the storage-battery plant at the Edison building, 139 Adams street, which was the site of the original generating plant of the company. This important addition to the company's equipment is interesting because of the magnitude of the installation, the particular service it is intended to give, the relative part it will play in the combination which comprises the system, and its significance as marking another distinct step in the development of the central-station service of Chicago.

It would doubtless be interesting to trace in detail the development of the central-station system of the company from the formation of the original corporation in 1887 to the present time, but for the purpose of this article it is only necessary to mention the principal events in the history of the enterprise in order to explain the expansion of the business to its present proportions and consequently the necessity for modifying the original plans which provided for a simple direct-current, low-tension system of distribution.

As already mentioned, the Adams street building, in which the storage batteries are placed, was the site of the original power plant of the Edison company. It was completed in August, 1888, and the equipment consisted of four engines and eight dynamos with a total capacity of 800 horse power. After several additions had been made it was found that a new power house would be required, so the Harrison street station was erected, the Adams street plant being abandoned in August, 1894, just six years after the first plant was started. The building was remodeled, the ground floor being used for the construction and supply departments, while the upper floors were devoted to the engineering and operating departments and the executive offices. In the basement a sub-station distribution system was installed, the equipment occupying the front part of the building. The storage-battery plant occupies 7,200 square feet of floor space and extends to the north end of the building. The electrical equipment of this distribution station was described and profusely illustrated in the Western Electrician of January 4, 1896. In addition to the natural growth of the business the company had acquired the property of the Chicago Arc Light and Power company in 1895, and established power plant on Wabash avenue and Twenty-seventh street, and North Clark street near Oak street, to supply current for lighting the residence districts in the North and South divisions. It was found convenient to rearrange the system, and a couple of years ago plans were prepared for this purpose. The changes provided for included the substitution of transformer sub-stations for the steam-generating equipment at the North Clark street and Wabash avenue power houses, current being received from the Harrison street power house at 4,300 volts and distributed at 115 to 125 volts. The plans for this important work and the apparatus

FIG. 5. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.—STRENGTHENING SUPPORTS AND BUILDING FOUNDATIONS FOR BATTERY.

employed formed the subject of a comprehensive article in the Western Electrician of January 1, 1898.

While these additions and improvements were being made the company enjoyed phenomenal prosperity in its original field, and the composite ampere curve for the low-tension system, which is presented in Fig. 1, clearly demonstrates this fact. The business growth of the company has been such during the last year, particularly, that the downtown winter maximum load increased from 36,000 amperes in 1896 to 44,000 in 1897, and it is estimated that should the present growth continue the winter maximum of 1898 on the downtown system will be in the neighborhood of 55,000 amperes. In fact a point had been reached where new investment in machinery or battery had to be made. The peak of the load occurs in winter during the period of short days at about 4:45 p. m., and is about 12,000 amperes in height, and the duration varies from 45 minutes to an hour and a quarter.

The conditions for a battery installation from a point of investment were considered favorable. Current was carried from the Harrison street station to the Edison building on Adams street, over a trunk line 3,340 feet in length, and was then distributed. The old Adams street site was therefore selected for a battery installation, as it made a large trunk-line investment unnecessary. Moreover, the center of load of the system had been gradually moving farther away from Adams street, and it was believed that good regulation at time of maximum load in winter, with feeders varying from 800 to 3,000 feet in length, would require either a booster system or a large outlay in copper. The battery solved the problem, as it was designed to discharge on two voltages, 125 volts to accommodate short feeders and 14 ovolts for long feeders; moreover, provision is made for a third end-cell switch, so that still another rate of discharge can be obtained,

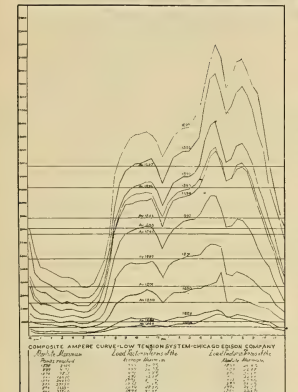


FIG. 1. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.—DIAGRAM SHOWING GROWTH OF BUSINESS.

of the work can be gained from a careful study of these sketches and photographic views.

Before the batteries were set up precautions were taken to determine whether the footings of the columns supporting the floors above would be sufficient to sustain the weight of a duplicate installation. It was found that new footings would be necessary, and the building was temporarily shored up, as shown in Fig. 5. The question of permanency in every detail was the first consideration, as the size of the installation and the limited area and head room made future alterations impracticable.

Some difficult problems were encountered in providing for sub-drainage, surface drainage, supports for the cells, the construction of the floor and protection of the columns and iron beams supporting the upper floors of the building and the ventilation of the battery rooms. A sub-drainage system of three-inch tile pipes laid in concrete was installed, and surface-drainage lead pipes were laid in sand, draining several lead-lined sumpts, both emptying into a large sump at the extreme south end of the room, which is emptied by a lead-lined centrifugal pump and discharged to the sewer.

To prevent settling, five four-inch I-beams were laid crosswise under each cell, and the space between was filled with concrete. Over this a few courses of tarred felt were laid.

The floor is of vitrified shale tiles, 10 inches square

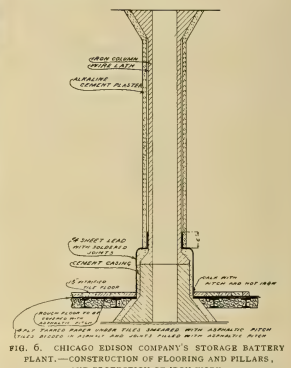


FIG. 6. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.—CONSTRUCTION OF FLOORING AND PILLARS, AND PROTECTION OF IRON WORK.

and two inches thick, laid in a mixture of 70 per cent. of asphalt to 30 per cent. of coal tar. The bottoms of the columns are encased in lead. The columns were carefully cleaned, then treated with a galvanic varnish, and afterward encased in wire lathing, over which a layer of alkaline cement plaster was placed. This was in turn covered with a coating of anti-acid paint. The details of construction of the floor and columns are shown in Fig. 6. All of the walls and ceilings are treated with the same plaster, which rendered them impervious to acid fumes.

Serious objection is often raised to the location of a storage-battery plant in an office building, because of the offensive fumes that arise from the cells. Experts claim that these gases are rather beneficial, but certainly they are not pleasant, and to many they are very objectionable. The subject was carefully considered in this case, and it is believed that the problem of properly ventilating a plant of this character was satisfactorily solved. Two ducts were run on opposite sides the entire length of the room, one for blowing in fresh air, the other for exhausting. A view of one of these pipes is given in Fig. 4. This system affords several cross currents of air, and effectually removes the gases, which are conveyed to the roof and blown to the outer air.

Of course the battery itself is one of the elec-

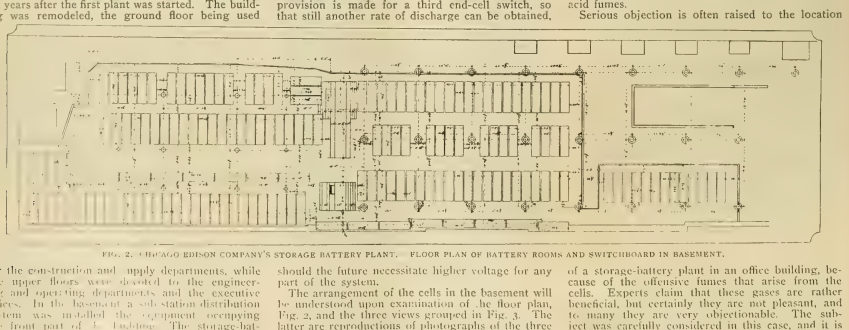


FIG. 2. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT. FLOOR PLAN OF BATTERY ROOMS AND SWITCHBOARD IN BASEMENT.

should the future necessitate higher voltage for any part of the system.

The arrangement of the cells in the basement will be understood upon examination of the floor plan, Fig. 2, and the three views grouped in Fig. 3. The latter are reproductions of photographs of the three rooms in which the batteries are set up. They may be designated as room 1, the extreme northerly section of the basement, room 2 the adjoining section on the south of room 1, and room 3, comprising a smaller space still south of the middle section, and occupying only about one third of the width of the building. The relative location of the switchboard is also indicated on the floor plan. An excellent view, looking down the long tier of batteries in room 1, is given in Fig. 4. Some idea of the magnitude

trical wonders of Chicago. To begin with, it is by far the largest battery plant that has ever been installed, and the special use to which it is being put lends additional interest to it. The battery has a capacity of 22,400 ampere-hours at an eight-hour rate, and it is also able to discharge 11,000 amperes for about 1¼ hours. It consists of 166 cells (60 of which are end cells), 83 on each side of the three-wire system. This large number of end cells is required to meet the peculiar conditions, especially the wide variations in pressure. The battery is called upon to deliver 140 volts on each side at the end of discharge, and in case of an emergency to deliver current at a maximum of 120 volts on each side when fully charged. Each

General View of Room No. 2 and End Cell Switches.
General View of Room No. 1, showing Porcelain Supports.

CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.

cell contains 87 plates (known as type "H" in the catalogue of the battery company), whose dimensions are 15⅞ by 32 inches. The positives are of the standard Manchester type. Each tank is 21¼ inches wide, 76⅞ inches long, and 43⅝ inches high, and weighs 6,290 pounds. The total weight of the battery, exclusive of conductors, is 1,020,200 pounds. The tanks are constructed of two-inch ash, lined with five-pound lead. They are each supported on 10 double petticoated insulators, resting on tiles laid on the acid-proof floor, as shown in Fig. 3.

The end cell are connected to the end cell switches, as shown in Fig. 7, by lead covered copper bars, six inches wide and one half inch thick, supported by insulators resting on iron girders running between the columns of the building. The main connections of the battery consist of two copper conductors, giving a sectional area of six square inches. The lead coating of the copper is a special feature, which renders the copper impervious to the action of the acid and gases.

There are three end cell switches on each side of the system. These switches have 30 points, and are capable of carrying 2,750 amperes each. The connection between the 30 contacts and the bus-bar of the switch is made by a laminated copper brush traveling on a screw operated by a one-half horse power series motor. These motors are put into operation by push buttons on the controlling switchboard (Figs. 8 and 9), but are stopped automatically when the brush reaches the mid-point on the contact block by an automatic device, which breaks the motor circuit and short-circuits the armature. The method insures the positive action of the end-cell switch without requiring attention of the switchboard operator. These switches are provided with a handwheel for hand operation, if desired. The gear wheels are provided so that the three switches can be geared together and operated as one switch, thus giving a capacity of 8,250 amperes on each side of the system.

The picture, Fig. 8, shows the feeder distribution room of the Adams street station, the storage-battery panel being the addition shown at the right on the end of the regular board. The diagram, Fig. 9 is a reproduction of the plan of the storage-battery panel. This controlling board is connected to the bus-bars of the end-cell switches by 12 cables of 1,500,000 circular mils each. On the controlling board there are three single-pole switches for each end-cell switch, enabling it to be connected to either the mains, auxiliary or charging buses. Each end-cell switch has an indicator on the controlling panel operated mechanically by light shafting and gearing, which shows the operator the exact position of the traveling brush on the end cell switch at all times. On each panel of the board there is a 30-point voltmeter switch, connected to a low-reading voltmeter, which enables the operator to take the voltage of the end-cell switches.

An important feature of this battery installation is the method of charging without the use of boosters, which are ordinarily employed in battery installations. The method designed for the Chicago Edison battery provides for the operation of a pair of 200-kilowatt machines in the Harrison street station at about 180 volts, which is the voltage required for charging and the transmission of the current over the trunk line from Harrison street to the battery station at Adams street. The voltage regulation of the dynamos is affected by an automatic control of the field resistance, which is secured by means of small motors under the control of the operator in the battery station at Adams street. Small lead-covered cables are run from Adams street to Harrison street, connecting with the motors controlling the field boxes. These generators, which are used for charging, were not built specially for the purpose, but are a part of the regular equipment, and at other periods of the day are used to feed into the main bus-bar of the station, thus saving an investment of about $15,000 in boosters, as well as providing a system of charging which is very much more economical than the one in which boosters are employed.

The battery will be kept in circuit throughout the day during the summer months, thus keeping the engines at the central station working at their most economical point, the battery being ready at any time to take care of sudden increases in load, as well as taking care of the peak in winter time, for which purpose it was primarily purchased. By maintaining the battery on the circuit continually, the necessity for regulation of pressure at the central station is very much lessened.

Details of Batteries in Room No. 1.

The batteries were furnished and installed by the Electric Storage Battery company of Philadelphia.

Development of the Central Station.

By Samuel Insull.

Part II.

Passing from a review of central-station plants and distribution systems naturally brings us to the operating cost and the factors governing profit and loss of the enterprise. In considering this branch of the subject, I will confine my remarks to the business as operated in Chicago by the company with which I am connected.

Our actual maximum last winter came on the 20th of December, our load being approximately 12,000 horse power. A comparison of the figures of maximum capacity and maximum load of last winter shows that we had a margin in capacity over output of about 20 per cent. The load curves shown this evening represent the maximum output of last winter (December 20th), an average summer load in a year (June 4th), and an average spring load on the year (May 24). For our purposes we will assume the maximum capacity of the plant and the maximum load of the system to be identical. The maximum load last winter occurred, as I have stated, on December 20th, about 4:30 o'clock in the afternoon, and lasted less than half an hour. It should be borne in mind that the period of maximum load only lasts for from two to three months, and that the investment necessary to take care of that maximum load has to be carried the whole year. It should not be assumed from this statement that the whole plant as an earning factor is in use 25 per cent. of the year. The fact is that, during the period of maximum load, the total plant is in operation

only about 100 hours out of the 8,760 hours of the year; so that you are compelled, in order to get interest on your investment, to earn the interest for the whole of the year in about 1½ per cent. of that period, on about 50 per cent. of your plant.

This statement must bring home to you a realization of the fact that by far the most serious problem of central-station management, and by far the greatest item of cost of your product, is interest on the investment. It may be that the use of storage batteries in connection with large installations will modify this interest charge, but even allowing the highest efficiency and the lowest cost of maintenance ever claimed for a storage-battery installation, the fact of high-interest cost must continue to be the most important factor in calculating profit and loss. This brings home to us the fact that in his efforts to show the greatest possible efficiency of his plant and distribution system, it is quite possible that the station manager may spend so much capital as to eat up many times over in interest charge the saving that he makes in direct operating expenses. It is a common mistake for the so-called expert to demonstrate to you that he has designed for you a plant of the highest possible efficiency, and at the same time for him to lose sight of the fact that he has saddled you with the highest possible amount of interest on account of excessive investment. Operating cost and interest cost should never be separated. One is much a part of the cost of your current as the other. This is particularly illustrated in connection with the use of storage batteries. Those opposed to their use will point out to you that of the energy going into the storage battery only 70 per cent. is available for use on your distribution system. That statement in itself is correct; but in figuring the cost of energy for a class of business for which the storage battery is particularly adapted, the maximum load, that portion of your operating cost affected by the 30 per cent. loss of energy in the battery, forms under 4½ per cent. of your total cost, and it must be self-evident, in that case at least, that the 30 per cent. loss in the storage battery is hardly an appreciable factor in figuring the operating cost of your product. So far as I have been able to ascertain, it would appear to be economical to use storage batteries in connection with central-station systems, the peak of whose load does not exceed from two to 2½ hours.

In order to illustrate the important bearing which interest has on cost, I have prepared graphical representations of the cost of current, including interest under conditions of varying load factors. For the purpose of this chart I have assumed an average cost of current, so far as operating and repairs and renewals and general expense are concerned, extending over a period of a year, although, of course, these items are more or less affected by the character of the load factor. For the purpose of figuring use of your investment being as low as the equivalent of 75 or 100 hours a year. Take another class of business, that of the haberdasher or small fancy-goods store. As a rule, these stores are comparatively small, with facilities for getting a large amount of natural light and little use for artificial light. The load factor, as shown by the chart, is about seven per cent., the use of your investment being not quite twice as long as that of the office building. Day saloons show an average of 16 per cent. load factor;

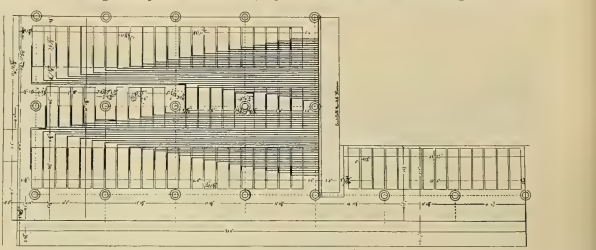


FIG. 7. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.—PLAN OF BATTERY ROOM NO. 2, SHOWING END CELLS IN POSITION AND CONNECTIONS.

cafetiers and small lunch counters about 20 per cent., while the large dry-goods stores, in which there is comparatively little light, have a load factor of 25 per cent., and use your investment seven times as long per year as the office building. Power business naturally shows a still better load factor, say 35 per cent., and the all-night restaurant has a load factor of 48 per cent.

You will see from this that the great desideratum of the central-station system is, from the investors' point of view, the necessity of getting customers for your product whose business is of such a character as to call for a low maximum and long average use. This question of load factor is by all means the most important one in central-station economy. If your maximum is very high and your average consumption very low, heavy interest charges will necessarily follow. The nearer you can bring your average to your maximum load the closer you approximate to the most economical conditions of production, and the lower you can afford to sell your current. Take, for instance, the summer and winter curves of the Chicago Edison company. The curve of December 20, 1897, shows a load factor of

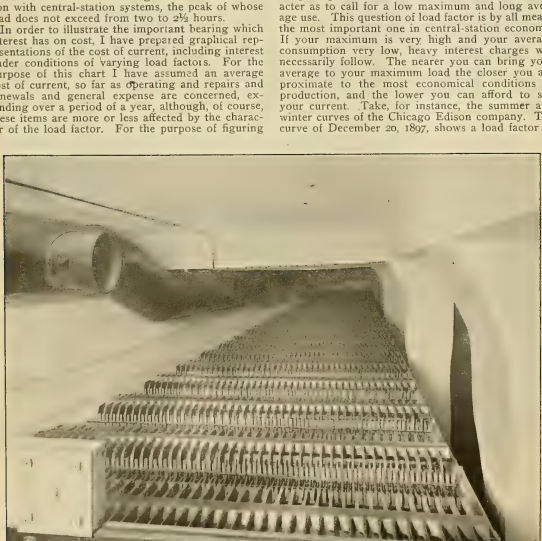


FIG. 4. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.—TIER OF CELLS; VENTILATING SYSTEM.

interest, I have selected seven different classes of business commonly taken by electric-light and power companies in any large city. Take, for instance, an office building. It has a load factor of about 3.7 per cent.; that is, the average load for the whole year is 3.7 per cent. of the maximum demand on you for current at any one time during that period; or, to put it another way, this load factor of 3.7 per cent. would show that your investment is in use the equivalent of a little over 323 hours a year on this class of business. This is by no means an extreme case. You can find in almost every large city customers whose load factors are not nearly as favorable to the operating company, their about 48 per cent.; the curve of May 2, 1898, shows a load factor of nearly 60 per cent. Now, if we were able in Chicago to get business of such a character as would give us a curve of the same characteristics in December as the curve we get in May; or, in other words, if we could improve our load factor, our interest cost would be reduced, an effect would be produced upon the other items going to make up the cost of current, and we probably could make more money out of our customers at a lower price per unit than we get from them now.

Many schemes are employed for improving the load factor, or, in other words, to encourage a long use of central-station product. Some companies adopt a plan of allowing certain stated discounts, providing the income per month of each lamp connected exceeds a given sum. The objection to this is that it limits the number of lamps connected. Other companies have what is known as the two-rate scheme, charging one rate for electricity used during certain hours of the day and a lower rate for electricity used during the balance of the day, using a meter with two dials for this purpose. Other companies use an instrument which registers the maximum demand for the month, and the excess over the equivalent of a certain specified number of hours monthly in use of the maximum demand is sold at greatly reduced price. The last scheme would seem particularly equitable, as it results in what is practically an automatic scale of discounts based on the average load factor of the customers. It does not seem to be just that a man who only uses your investment, say, 100 hours a year, should be able to buy your product at precisely the same price as the man who uses your investment, say, 3,000 hours a year, when the amount of money invested to take care of either customer is precisely the same. Surely the customer who uses the product on an average 30 times longer than the customer using it for only 100 hours is entitled to a much lower unit rate, in view of the fact that the expense for interest to the company is in one case but a fraction per unit of output of what it is in the other. This fact is illustrated by the interest columns on the graphic chart already referred to. Supposing that the central-station manager desired to sell his product at cost, that is, an amount sufficient to cover his operating, repairs and renewals, general expense and interest and depreciation, he would have to obtain from the customer having the poorest load factor, as shown on the load chart, over four times as much per unit of electricity as it would be necessary for him to collect from the customer having the largest load factor. No one would think of going to a bank to borrow money and expect to pay precisely the same total interest whether he required the money for one month or for 12; and for the same reason it seems an absurdity to sell electricity to the customer who uses it but a comparatively few hours a days a year, when it is remembered that interest is the largest factor in cost, and the total amount of interest is the same with the customer using it but a few hours a year as it is with the customer using it practically all the year around.

I have dwelt thus at length on the question of interest cost in operating a central-station system, not alone for the purpose of pointing out to you its importance in connection with an electrical distribution system, but also to impress upon you its importance as a factor in cost, in fact, the most important factor in cost in any public-service business which you may enter after leaving this institution. Most of the businesses presenting the greatest possibilities from the point of view of an engineering career are those requiring very large investment and having a comparatively small turn-over or yearly income. Of necessity, in all enterprises of this character, the main factor of cost is interest, and if you intend following engineering as a profession, my advice to you would be to learn first the value of money, or, to put it another way, to learn the cost of money.

Before leaving this question of interest and its effect upon cost, I would draw your attention to the fact that while interest is by far the most important factor of cost, it is a constantly reducing amount per unit of maximum output in practically every central-station system. When a system is first installed, it is the rule to make large enough investment in real estate and buildings to take care of many times the output obtained in the first year or so of operation. As a rule the generating plant from the boilers to the switchboard is designed with only sufficient surplus to last a year or so. In the case of the distributing system the same course is followed as in the case of real estate and buildings, with a view to minimizing the ultimate investment. Mains are laid along each block facing; feeders are put in having a capacity far beyond the necessity of the moment; consequently interest cost is very high when a plant first starts, except as I have stated, in the case of the machinery forming the generating plant itself. As the business increases from year to year the item of interest per unit of maximum output consequently will constantly decrease, owing to the fact that each additional unit

of output following an increase of connected load increases the divisor by which the total interest is divided. The result is from year to year the interest cost of each additional unit of maximum output is a constantly reducing amount, and consequently the average interest cost of each unit of maximum

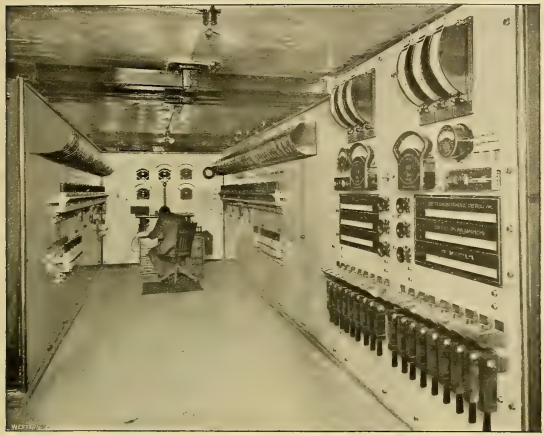


FIG. 8. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.—FEEDER DISTRIBUTION ROOM AND STORAGE BATTERY CONTROLLING-BOARD.

output should, in a well-regulated plant, grow less from year to year until the minimum interest cost per unit is reached. This minimum interest cost is reached when the capacity of the whole system and the total units of output at maximum load are identical, although, of course, it will always be necessary to have a certain margin of capacity over possible output, as a factor of safety.

This same rule, although to a less extent, applies to the operating and general expense cost, that is, the cost other than interest. To particularize, the manager's salary and other administrative expenses do not increase in proportion to maximum output of station; therefore the cost of administration per unit of output, if the business is in a healthy condition, must be from year to year reduced. There are a great many other expenses that are not directly in proportion to output, and these follow the same rule. In a well-run plant the percentage of operating expenses to gross receipts will stand even year after year, while the income per unit of output will be constantly reduced. This is an excellent evidence of the fact that the cost per unit of output is constantly being reduced, as, if it were not, the percentage of expenses to gross receipts would be increased in direct proportion to the reduction in price.

Moreover, it should be borne in mind that there are many difficulties in the way of universal use of electric energy from a central-station system. It is the rare exception to find a house not piped for gas and water. In the case of the latter it is almost invariably the rule that owners are compelled to pipe for water, under the sanary code of the municipality. On the other hand, in a large residential district, it is the exception to find a house wired for electric light; consequently the output of current per foot of conductor is at the present time very low as compared with the output of gas per foot of gas-pipe in any of the large cities. The expense of wiring (which must of necessity be borne by the householder) is large, and it is often a barrier to the adoption of electric illumination, but, as the rule to wire houses becomes more general, the output per foot of main will constantly increase, and therefore the interest per unit of output per foot of main will constantly decrease. This same rule will apply in the case of expenses of taking care of and repairing the distribution system, although to not so great an extent.

If you will take into account these various factors constantly operating toward a reduction of operating and general expense cost and interest cost, the conclusion must necessarily be forced upon you that the price at which current can be sold at a profit to-day is in no sense a measure of the income per unit which it will be necessary for central-station managers to obtain in the future. In 1881-82 it was difficult to make both ends meet with an income of 25 cents per kilowatt-hour; to-day there are many stations showing a substantial return on their investment whose average income does not exceed seven cents per kilowatt-hour, showing 70 per cent. reduction in price in less than two decades. How far this constant reduction in cost, followed by a constant reduction in selling price, will go, it is difficult to determine; but if so much has been accomplished during the first 20 years of the existence of the industry, is it too much to predict that in a far less time than the succeeding 20 years electric current for all purposes will be within the reach of the smallest householder and the poorest citizen?

But few industries can parallel the record already obtained. If you will trace the history of the introduction of gas as an illuminant you will find that it took a much longer time to establish it on a commercial basis than it has taken to establish most

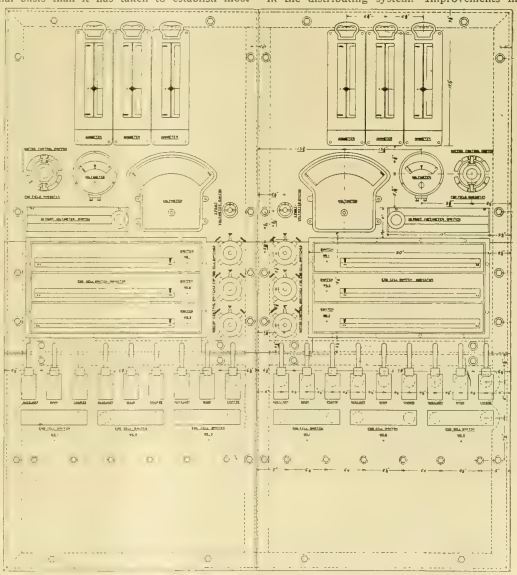


FIG. 9. CHICAGO EDISON COMPANY'S STORAGE BATTERY PLANT.—STORAGE BATTERY SWITCHBOARD PANEL.

firmly the electric-lighting industry. All the great improvements in gas, the introduction of water gas, the economizing in consumption by the use of the Welsbach burner, have all been made within the time of those before me, and yet, notwithstanding that when these gas improvements started the electric-lighting business was hardly conceived, and certainly had not advanced to a point where you could claim that it had passed the experimental stage, notwithstanding this, the cost of electrical energy has decreased so rapidly that to-day there are many large central-station plants making handsome returns on their investments at a far lower average income per unit of light than the income obtained by the gas company in the same community. In making my calculations which have led me to this conclusion, I have assumed that 10,000 watts are equal to 1,500 feet of gas. This comparison holds good, providing an incandescent lamp of high economy is used as against the ordinary gas-burner. To make a comparison between electric illumination and incandescent gas-burners, such as the Welsbach burner, you must figure on the use of an arc lamp, in the electric circuit instead of an incandescent lamp, which is certainly fair when it is remembered that incandescent gas-burners are, as a rule, used in places where arc lamps should be used if electric illumination is employed.

With such brilliant results obtained in the past, the prospects of the central-station industry are certainly most dazzling. While the growth of the business has been phenomenal, more especially since 1890, I think it can be conservatively stated that we have scarcely entered upon the threshold of the development which may be expected in the future. In very few cities in the United States can you find that electric illumination exceeds more than 20 per cent. of the total artificial illumination for which the citizens pay. If this be the state of affairs in connection with the use of electricity for illuminating purposes, and if you will bear in mind the many other purposes to which electricity can be adapted throughout a city and supplied to customers in small quantities, you may get some faint conception of the possible consumption of electrical energy in the not far distant future. Methods of producing it may change, but these methods cannot possibly go into use unless their adoption is justified by saving in the cost of production, a saving which must be sufficient to show a profit above the interest and depreciation on the new plant employed. It is within the realms of possibility that the present form of generating station may be entirely dispensed with. It has already been demonstrated experimentally that electrical energy may be produced direct from the coal itself without the intervention of the boiler, engine and dynamo machine. Whether this can be done commercially remains to be proved. Whatever changes may take place in generating methods, I should, were I not engaged in a business which affords so many remarkable surprises, be inclined to question the possibility of any further material change in the distributing system. Improvements in the translating devices, such as lamps, may add enormously to the capacity of the distributing system per unit of light; but it does seem to me that the system itself, as originally conceived, is to a large extent a permanency. Should any great improvements take place in the medium employed for turning electrical energy into light, the possible effect on cost, and consequently selling price, would be enormous

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To the members of the National Electric Light association and the Northwestern Electrical association the Western Electrician extends a cordial greeting and hearty welcome to Chicago.

The arrangements for the convention of the National association in this city next week provide for a series of interesting meetings at which papers upon live topics by experts of recognized ability in the profession will be read. In addition there will be afforded ample opportunity for visiting the big lighting and power plants of the city and inspecting every feature of interest to central-station men and engineers. The social features include a reception on Monday evening that should prove thoroughly enjoyable, and other entertainments on succeeding days, as outlined elsewhere in this issue. The Chicago meeting is intended to be a businesslike affair, in keeping with the importance of the industry.

The Northwestern association will hold its summer convention immediately after the adjournment of the National association, and it is anticipated that many members of both organizations will attend both meetings. The members of the Northwestern association have adopted a novel plan for their convention which should prove attractive. The plan is for the members to assemble in Chicago and embark for Duluth upon the steamer Northwest on June 10th, holding meetings en route. This arrangement has been highly commended, and it is believed many distinguished electrical men will take advantage of the opportunity to enjoy an outing with old business friends.

The Western Electrician, on behalf of the electrical fraternity throughout the West, bids the visitors welcome, and assures them that Chicago appreciates the honor conferred upon it by their presence.

The exhibition at Omaha possesses many features of interest to electrical men, particularly those engaged in long-distance power transmission. Special attention has been given this feature, and complete equipments for this class of work are shown in operation. The opening exercises this week found the grounds and buildings in a fair state of readiness. The electricity department is expected to prove one of the most attractive features of the exhibition.

It is of vital importance to the independent telephone movement that united action be taken in all matters affecting the industry, and for this reason alone everything that tends to promote friendly intercourse should be encouraged. The telephone-exchange managers of this state have formed the Illinois Telephone association, and they will hold a meeting at Mattoon next week. They have already enlisted the support of a large number of independent companies, and are hopeful of increasing the membership and adding to the influence of the organization at the same time. This movement should be encouraged by the industry generally, especially as this is one of the most promising fields in the country.

Mr. Clausen's article on "Operating Telephone and Electric-lighting Systems in Conjunction" is an interesting contribution, and cannot fail to attract attention among central-station managers in the smaller towns of the Northwest, particularly where telephone service is so greatly needed. There is no serious objection to such an arrangement, and there are many reasons why it should prove advantageous. Mr. Clausen offers some valuable suggestions upon the construction, operation and management of telephone systems of this character. The plan has already been given a trial in a few cases with marked success, and it is probable that it will prove popular elsewhere. It is worthy of consideration on the part of telephone and electric-lighting interests.

Considerable disappointment has been manifested because of Judge Seaman's failure to pass upon the right of the City Council of Milwaukee to regulate the rate of fare for street-railway service in the litigation over the four-cent fare ordinance enacted a year ago in that city. In his decision Judge Seaman assumed, for the purpose in hand, that the municipality possessed the power to reduce rates of fare where excessive, and then decided the Milwaukee ordinance invalid on the ground that the rates fixed were unreasonable and did not allow the company a fair profit on the money invested. Judge Seaman calculated, from the expert testimony presented, that a fair value of the property of the company, "based solely on the cost of reproduction," would be at least $5,000,000, and the return upon the investment, on the most liberal estimate, would be only 7.2 per cent., while, according to the claims of the company, the percentage of profit was even smaller. The case may go to the Supreme Court of the United States.

The time for commencement exercises is at hand, and in the next few weeks the army of titled graduates of educational institutions throughout the country will be increased by many thousands of recruits. The ranks of the engineering profession will no doubt receive their share of the new comers, and it is not improbable that there will be many brilliant and accomplished experts introduced to the commercial world, but there will be many more turned loose who desire to embark on a professional career, although they have no especial aptitude for anything save avoiding manual labor. These young men need to be impressed with the dignity of labor. They should be taught that a man may occupy an humble position in life and yet serve a better purpose, if he be content to do his allotted task well, than one who attempts that which is beyond his capacity and goes through life a failure in everything. It is a mistaken notion, too, that honors and wealth are easily acquired in the learned professions. Rarely, indeed, is distinction attained or fortune accumulated excepting through untiring industry and constant application. Genius is seldom rewarded in gold.

Interest in the Philippines naturally stimulates a desire for direct telegraphic communication with Asia, and emphasizes the necessity for laying the Pacific cable. Immediate action is urged by Congress on this subject. The Sun says: "Direct telegraphic communication with Manila by way of Honolulu should be provided as soon as possible by the Congress of the United States. When the war is over the Honolulu and Manila cable will become the instrument of political administration, and, later, of a peaceful commerce, vast beyond the imaginings of enthusiasm and profitable beyond the dreams of avarice. Then, if the government wants to sell, there will be no lack of purchasers."

We do not anticipate that there will be an immediate return upon the capital required for establishing the Pacific cable, but it is quite probable that the enterprise will prove profitable eventually. However, this consideration should not influence the government one way or the other. Just now the cable is a necessity of war, while later it will doubtless prove an effective agent in promoting American trade abroad. The Chicago Record says: "If the United States is to have permanent interests in Asiatic waters it certainly should have cable connection of its own with them, and not be obliged to depend for intelligence upon lines running through the ports of many other countries. But even if the United States should not hold the Philippines, as it is to be hoped it may see its way clear not to do, a cable line to the Asiatic coast would, nevertheless, be of much importance. Trade, to a considerable extent, follows lines of communication, and a Pacific cable would do much to develop better commercial relations with the peoples of the Orient. In many ways it would be an advantage to the United States to have a direct means of speedy communication with those peoples, instead of being compelled to use European cables. The laying of such a cable would in itself be an act tending to stimulate closer relations between the peoples of the two shores of the Pacific. The construction of a Pacific cable, too, would be an accomplishment of civilization of which the United States would have cause to be proud."

This is a common-sense view of the situation, and the experience of other cable enterprises warrants the conclusions reached. Our commercial relations with Mexico and Central and South American countries did not warrant the establishment of cable lines, but trade soon developed, once communication was established, and these enterprises are now profitable investments.

NORTHWESTERN ELECTRICAL ASSOCIATION.

The novelty of the plan proposed by the Northwestern Electrical association for its summer convention has attracted much attention to the project. It is proposed to hold the meeting on the steamer Northwest while making a trip between Chicago and Duluth.

Heretofore it has been customary to hold the summer meetings of this organization at some convenient resort particularly attractive in hot weather, and many of the members have taken advantage of these events to combine their annual outing with

NORTHWESTERN ELECTRICAL ASSOCIATION.—STEAMER NORTHWEST CHARTERED FOR THE EXCURSION CONVENTION.

the convention. This fact, together with the expectation of a large attendance of central-station men at the national meeting in Chicago, led the Northwestern association to consider the advisability of undertaking a more ambitious scheme than had hitherto been attempted. The steamer Northwest was accordingly engaged for the trip, and the citizens of Duluth and West Superior extended invitations to the organization to visit those cities. Other cities along the route took similar action, and the association adopted the plan.

It is proposed to leave Chicago at noon, on June 10th, the day following the closing of the convention of the National association. The party will arrive at Milwaukee the same evening, and the trip to Mackinac will occupy the night. An opportunity to enjoy the sights at this point will be given, as the boat will stop from 7 a. m. until 10:30. This will make it possible to reach Sault Ste. Marie at 5 p. m., which is the most delightful hour of the day for entering the locks. The first of these gates to meet the traveler's eye is that presented in the picture on page 330. The structure at the right is the new government house, and the top of the old citizens of Houghton and Hancock will take charge of the party and show the visitors the famous Calumet and Hecla mines. At 2 p. m. they will return to the steamer and start for Duluth, which they will reach the same evening. A view of the city from the steamer is presented in the picture on this page. A reception will be tendered the association by the citizens, and every opportunity afforded the visitors to view the many industries of the town. On Wednesday a special train will carry the party to Minneapolis, where the power system of the falls of St. Anthony will be examined. A dinner will be given at the West Hotel. This will practically close the affair, and the party will return to Chicago, arriving in this city on Thursday morning. The accompanying map shows the route to be followed, and indicates the points at which stops will be made.

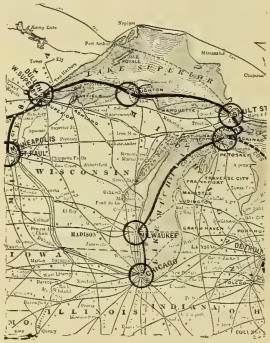
The trip between Chicago and Duluth will doubtless be a very enjoyable one, providing the weather is fine, as it is unquestionably one of the most attractive the country affords. The steamer Northwest has been described as a floating palace, and those who have enjoyed the luxury of that magnificent vessel agree that the title is appropriate. Of the trip itself, the beautiful scenery and the points of interest along the route, much has been written, but probably nothing more entertaining and appropriate than Jeannette L. Gilder' description in the Chicago Tribune:

"On the voyage west we reached the Soo, with its wonderful locks, at about eight o'clock in the evening. We were then 18 feet below Lake Superior, but gradually we lifted until we reached its level and glided gently out upon its cold, deep waters. It made me shudder to think that there were a thousand feet of water underneath us, though we could drown just as surely in less than half of that. It interested me to see how easily our captain handled his immense ship. We never even grazed the sides of the lock, and on the lakes we passed other ships so near that we could have exchanged cards had we been so inclined. As it was, we exchanged foghorn salutes.

"I had often heard of Duluth, but no description of this singular town gave me any idea of its actual peculiarities. As we approached it, the city seemed to rise up and call us blessed. Where were the streets? Not those perpendicular lines, certainly? Yes; there was no doubt about that. From the lake shore to the top of the hill. They stood on end. And the houses—each one appeared to be standing on the shoulders of the one below it to get a peep into the lake! How can people live in them? I should think that they would have to go about with wedges under their feet to keep from tumbling out. I noticed that all the wagons in Duluth were furnished with brakes, and I should think that pedestrians, too, would have brakes on their legs for descending the perpendicular sidewalks. Even walking in the horizontal streets can only be comfortable to those persons who have one leg shorter than the other."

It will be noticed by those familiar with the course of the Northwest that she will not follow the usual line between the Soo and Duluth, which carries her farther north, near Isle Royale. On entering Lake Superior she will lay her course almost directly west after passing Whitefish Point and make a quick run to Portage entry, affording the visitors an opportunity to inspect the Calumet and Hecla copper country about Hancock and Houghton. This will enable them also to pass through the Apostle Islands before entering Duluth.

It is not intended to have a set programme for the convention, although it is believed there will be plenty of interesting and valuable discussions. There will be many prominent electrical men in the party, and it is believed that Mr. Edison, Professor Gray, Mr. Sprague, Professor Thomson, Mr. Wood and Mr. Stanley will accept the invitations of the association. Edward Weston has signified his willingness to assist in making the event successful, and he is expected to deliver an address upon "Electrical Measuring Instruments." A paper on the



NORTHWESTERN ELECTRICAL ASSOCIATION.—MAP SHOWING PROPOSED ROUTE OF STEAMER NORTHWEST WITH CONVENTION PARTY.

"Electrical Smelting of Ores" will be read by W. S. Horry, the electrical engineer who constructed the furnaces for the Union Carbide company at Sault Ste. Marie. Both Edison and Professor Thomson are deeply interested in this subject, and it is anticipated that the informal discussion that will follow the reading of the paper will have much interest. Other topics for discussion have been selected, including "Lightning Arresters," "Transformers," "Meters," "Arc and Incandescent Lamps," "Motors," "Engines," "Furnaces" and "Mechanical Drafts."

Mr. J. M. Hill of Chicago, who has charge of the arrangements for the trip, has been working upon the details of the plan for fully a year. Mr. Hill secured the invitations from the cities of Duluth and West Superior and succeeded in interesting many prominent men of the Northwest in the affair. It was through his personal efforts that the association was induced to consider the proposition.

The steamer will arrive in Chicago on Wednesday or Thursday, and will tie up at Kirk's dock, where she will be open for inspection. Invitations to members of the National Electric Light association and others interested in electrical matters are extended.

A committee of prominent citizens from Duluth and West Superior, representing the municipal governments, chambers of commerce and other public institutions in both cities, will accompany the steamer on its trip from Duluth to Chicago to escort the association back to Duluth.

NORTHWESTERN ELECTRICAL ASSOCIATION.—VIEW OF THE CITY OF DULUTH FROM STEAMER APPROACHING HARBOR.

observation tower in the background can just be seen protruding above the lock. A steamer waiting to come down is also partially shown in the picture. The second view of the Soo discloses a comprehensive scene, embracing the park at this famous resort. Here the visitors will be entertained Saturday evening, and an opportunity will be afforded to attend service on Sunday, as the boat will not leave until noon. The next stop will be at Hancock, which will be reached at 4 a. m. Monday. Here the

Charles Foster of Ames, Ia., has gone to Algona, Ia., to take charge of the electric light plant.

FINDING LIST FOR CONVENTION VISITORS.

The following list of Chicago addresses has been prepared with the hope that it may help out-of-town visitors to the convention to find their way to points of interest, electrical and otherwise. It could, of course, be greatly lengthened, but the idea has been merely to collect in convenient form for reference a few of the addresses that may be sought, by the ladies as well as by the gentlemen.

Armour Institute of Technology, Thirty-third street and Armour avenue. The electrical laboratory is exceptionally well equipped.

Art Institute of Chicago, Michigan avenue, opposite Adams street.

Auditorium Tower, Congress street, near Wabash avenue.

Board of Trade, Jackson street, opposite La Salle street. Aside from its attraction to the general visitor, this building has an interesting isolated plant.

Central Electric company, 264-270 Fifth avenue.

Central Union Telephone company, thirteenth floor of Ashland block, Clark and Randolph streets.

Chicago Edison Railway company, 2020 State street. The company has two large electric power houses—one at Wabash avenue and Fifty-second street and the other at Oakley avenue and Forty-ninth street.

Chicago Edison company, 139 Adams street (offices and sub-station). The generating plants of the company are located as follows:
Main down-town plant, Harrison street and the river.
Series are lighting (old Chicago Arc Light and Power company), Washington and Market streets.
North Side—North Clark street, near Oak street.
South Side—Wabash avenue and Twenty-seventh street.

Chicago Electrical association. Office of the secretary, J. R. Cravath, is at 832 Monadnock building.

Chicago Electric Traction company, Eighty-eighth street and Vincennes avenue. This is the company operating the Englewood and Chicago storage-battery road. The quickest way to visit this interesting plant is to take a Rock Island train station at Van Buren street (or Twelfth avenue) to South Englewood. A longer time is consumed in taking the Alley "L" to Douglas Park avenue station, and there connecting with a storage-battery car, which, of course, will take the visitor to the power house.

Chicago Manual Training School, Michigan avenue and Twelfth street.

Chicago Telephone company's building, Washington and Franklin streets.

City Electrical Department, 14 City Hall. The municipal electric-lighting stations are located as follows:
North Side—Sedgwick street and Chicago avenue.
South Side—Fourteenth street and Indiana avenue.
West Side—Halsted street and Fine Indiana avenue. (In process of erection)—Rice and Lincoln streets.

City Hall, Randolph, Clark, Washington and La Salle streets.

Clubs—
Chicago Athletic Association, 125 Michigan avenue.
Chicago Club, Michigan avenue and Van Buren street.
Columbus Club, 43 Monroe street.
Union League Club, Jackson street and Custom House court.

Commonwealth Electric company, 139 Adams street. The central stations embraced in this company's system are as follows:
Englewood Electric Light company, Sixty-fourth street, near State street.
Hyde Park Electric Light and Power company, 7284 South Chicago avenue.
Hyde Park Thomson-Houston Electric Light company, 37 Fifty-third street.
Mutual Electric Light and Power company, Eighty-ninth and South Ada streets.
People's Electric Light and Motor Power company, Fifty-fifth and Wallace streets.
West Chicago Light and Power company, 1052 West Madison street.
Western Light and Power company, 670 Lincoln avenue.

Douglas Monument, lake shore, foot of Thirty-fifth street.

Electric Appliance company, 242 Madison street.

Ferris Wheel, 1288 North Clark street.

Fort Wayne Electrical corporation, 624 Marquette building, Dearborn and Adams streets.

General Electric company, 1047 Monadnock building, Dearborn and Van Buren streets.

Haymarket Square, West Randolph and Desplaines streets. This was the scene of the anarchist riot of May 4, 1886. It contains the monument commemorating the death of the policemen killed on that occasion.

Hotels—
Auditorium Hotel, Michigan avenue and Congress street. Headquarters of the association. The Auditorium isolated plant is the largest in Chicago.
Grand Pacific Hotel, Clark and Jackson streets.
Great Northern Hotel, Dearborn and Jackson streets.
Palmer House, State and Monroe streets.
Victoria Hotel, Michigan avenue and Van Buren street.
Wellington Hotel, Wabash avenue and Jackson street.

Lake Street Elevated Railroad company, 444 North Clark street. This is practically a part of the "Yerkes system." (See North Chicago Street Railroad company.)

Lewis Institute, West Madison and South Robey streets.

Logan Monument, Lake Front Park, opposite Eldredge place.

Marshall Field's store, State and Washington streets and Wabash avenue; wholesale building, 200 Adams street.

Masonic Temple, State and Randolph streets.

Metropolitan West Side Elevated Railroad company, 200 Franklin street. The trains on this road are pulled by electric motor cars. The power house is at Throop and Van Buren streets.

North Chicago Street Railroad company, 444 North Clark street. This is a part of the "Yerkes system," which is supplied with electrical energy from three large power houses located at California avenue and Roscoe boulevard, Western avenue and Washington boulevard and on Hawthorne avenue between Chicago avenue and Division street.

Parks—
Douglas Park. One entrance is at Ogden and California avenues.
Garfield Park. One entrance is at West Madison street and Central Park avenue. This is a pleasing park. The new electric-light plant is near Hamlin avenue and Kinzie street.
Humboldt Park. One entrance is at California avenue and West Division street.
Jackson Park. One entrance is at Stony Island avenue and Fifty-seventh street. This is the largest park in the city and famous as the site of the World's Fair. It contains the Field Columbian Museum and many other memorials of the World's Fair, shaded lagoons and Rose Garden, etc.
Lincoln Park. One entrance is at North Clark street and North avenue. This is perhaps the most attractive park in the city. It contains the famous Lincoln monument of St. Gaudens, the imposing Grant monument, several other fine pieces of statuary, a menagerie, the electric fountain, the Academy of Sciences, etc.
Washington Park. One entrance is at Cottage Grove avenue and Fifty-first street. This is a large park with fine drives, an extensive common and a conservatory of exceptional size.

Postal Telegraph-cable company, thirteenth floor Stock Exchange building, La Salle and Washington streets.

NORTHWESTERN ELECTRICAL ASSOCIATION.—FIRST LOCK.

Public Library, Wabash avenue, Washington to Randolph streets. This building has an interesting electrical plant and fine fixtures.

Pullman. This interesting manufacturing community is about 14 miles south of the center of the city, on the Illinois Central railroad.

Races (Harlem Race Track), daily at 2:30 p. m. The Lake street "L" trains run to the track.

Roof Garden (Masonic Temple), State and Randolph streets.

Siemens & Halske Electric company, 1215 Monadnock building.

South Side Elevated Railroad company, 47 Congress street. The work of equipping this road for electrical operation is being finished. The new Sprague multiple-unit system is used, each car being an independent motor unit. The power house is at State and Forty-fifth streets.

Sprague Electric company, 1522 Marquette building, Dearborn and Adams streets.

Stanley Electric Manufacturing company, 1506 Marquette building, Dearborn and Adams streets.

Theaters—
Chicago Opera House, 118 Washington street. Continuous vaudeville.
Grand Opera House, 87 Clark street. Weber & Fields' "Lousse Cafe" company.

West Chicago Street Railroad company, 89 West Washington street. This is a part of the "Yerkes system." (See North Chicago Street Railroad company.)

Western Electric company, 242-258 South Jefferson street.

Western Electrician, 510 Marquette building, Dearborn and Adams streets.

Western Society of Engineers, 1737 Monadnock building, Dearborn and Van Buren streets. The society possesses a good technical library.

Western Union building, Clark and Jackson streets and Pacific avenue.

Westinghouse Electric and Manufacturing company, 7 9 New York Life building, La Salle and Monroe streets.

NORTHWESTERN ELECTRICAL ASSOCIATION.—VIEW OF PARK AT SOO.

Great Northern, 81 Jackson street. Henderson's stock company in "Held by the Enemy."
Hooley's, 149 Randolph street. Daly's company in "The Circus Girl."
McVicker's, 75 Madison street. Otis Skinner and company in "Shenandoah."
Schiller, 107 Randolph street. Schiller stock company in comic opera, "Paul Jones."

Union Stock Yards, Thirty-ninth to Forty-seventh streets and Halsted street to Ashland avenue. The main entrance is at Root and Halsted streets.

University of Chicago, Fifty-seventh to Fifty-ninth streets and Ellis to Lexington avenues.

Walker company, 1323 Marquette building, Dearborn and Adams streets.

Electric Railway Litigation.

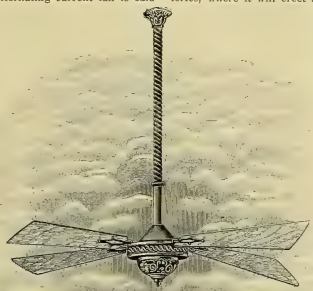
In the case of the General Electric company against the Union Railway company and the Walker company, relating to the infringement of the Sprague motor-suspension patent of 1885 by a method put forth under a similar patent granted to Professor Short 10 years later, Judge Shipman, speaking for the United States Circuit Court of Appeals for the Second Circuit, decides that two of the claims of Sprague's patent were infringed. One paragraph of the judge's opinion is of special interest: "The Sprague invention was not a pioneer and was not of a broad character, but it was a distinct and clearly defined invention in the method of hanging electric motors for vehicles, and its gist consisted in the utilization of the frame of the motor itself with the necessary extension and the centering of the motor on the driven axle by extension pieces from the field magnet at one end, and in its flexible suspension at the other end to the car truck, the armature being carried rigidly by the field magnet." The court limits the infringements to claim 2 and claim 6 of the Sprague patent, however, and the finding of the lower court is modified by removing claim 9, which the Circuit Court held to have been infringed also, from consideration.

The General Electric company considers also that the decision rendered by Judge Townsend in the United States Circuit Court for the District of Connecticut, in the suit brought under the Condict series-parallel controller patent, is of far-reaching importance. This is the decision mentioned in the Western Electrician last week, the title being "Electric Car company of America and Thomson-Houston Electric company against the Hartford and West Hartford Railroad company and others." This statement is made on behalf of the owner of the patent: "Since the introduction of the Condict method of series-parallel control it has superseded all other methods, and it is safe to say that practically every street-car controller to-day employs it. Therefore, the decision of Judge Townsend sustaining the claims relating to this method of control goes far towards placing the practical control of the electric-railway business in the hands of the General Electric and Westinghouse companies, which control the patent."

It is announced that a commission of experts has been appointed in Switzerland to consider the best methods of preventing accidental contacts between overhead electric railway conductors and wires used for telegraphic and telephonic communications. The commission includes Dr. A. Beding, Dr. H. F. Weber, Dr. Hagenbach-Bischoff, Dr. Koepsel and R. Thury.

Bates Alternating-current Ceiling Fan.

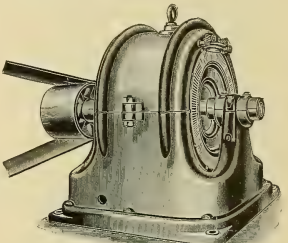
The ceiling fan herewith illustrated is made by D. L. Bates & Bro. of Dayton, O., and the motor is designed to be operated on alternating-current circuits. The fan is self-starting and provided with a switch at the bottom of the basket. The sweep of the blades is five feet two inches and the speed from 180 to 200 revolutions per minute. The motors are wound for any voltage and any frequency, and have self-oiling bearings. The actual power taken by the Bates alternating-current fan is said to be 140 watts. The firm makes this explanation: "Inasmuch as the 'power factor' of the motor is nearly .7 the apparent energy is about 200 watts. Therefore these fans, if connected to current meters, would be charged with much more power than they actually consume, and customers using such meters should make special arrangements with the electric-light company for the current taken by the fans. The above figures refer to fans for high-frequency currents. On circuits of low frequency (7,200 alternations), our fans take about 120 apparent watts and 100 true watts."



BATES ALTERNATING-CURRENT CEILING FAN.

Warren-Medbery Inductor Alternator.

This machine, illustrated herewith, was described in detail in the Western Electrician of May 21st. The cut shows a 150-kilowatt dynamo recently installed in a central station at Ballston Spa. The manufacturer is the Warren-Medbery company of Sandy Hill, N. Y. The efficiency of the machine is said to be equal to the best designs of direct-current generators, and the inherent regulation is claimed to be the best yet attained in alternators of any type. The placing of all the armature coils in a single wreath at one end of the machine and the surrounding of every armature pole with an armature coil are thought to produce better combined efficiency and regulation and a more correct form of current wave than any other construction.



WARREN-MEDBERRY INDUCTOR ALTERNATOR

Heavy Electric Railroading Proposed in France.

An enterprise involving the expenditure of not less than 40,000,000 francs or $8,000,000 and the creation of a road about 2½ miles long, partly underground, to be operated exclusively by electricity, is about to be undertaken in the city of Paris by the Orleans railroad. The main terminal of this railroad, which operates about 4,300 miles of track in the west and southwest of France, is at the Place Valhubert, near the Pont d'Austerlitz and the Jardin des Plantes, in the extreme east of Paris. The traveling population of Paris does not live in the eastern part of the city but in the western, in which direction the city is steadily growing, and access to the present Orleans station in most cases involves carriage transportation. The Orleans company has, therefore, decided to prolong its line into the very heart of Paris, and for this purpose has secured a right-of-way underground to a point on the left bank of the Seine, opposite the Garden of the Tuileries, where it will erect a terminal station. Visitors to Paris, since the year 1872, have had the ruins of the Cour des Comptes pointed out to them as an example of the ferocity of the Commune; it is on this spot that the new Quai d'Orsay station of the Orleans railroad is to be erected. The accompanying outline map of Paris (Fig. 1) shows the proposed extension.

The new road will have two tracks and will drop from the Valhubert station on a grade of 1.1 per cent. towards the Seine. Here the river banks are in two stories, an upper quay or roadway and a lower quay used as a dock or wharf for canal boats. A belt, nine meters wide, has been secured on this lower quay, and the line will follow this in the open for 650 meters. It will be an underground road beneath the upper quay for the remainder of the distance until it reaches the terminus under the Cour des Comptes. Openings in the wall side of the quay facing the river will afford light and ventilation. The rail level is about that of the normal height of the water; any seepage water in times of flood will be gathered in a sump and drained out.

The road follows the line of the Quais St. Bernard de la Tournelle, de Montebello, St. Michel, des Grands Augustins, de Conti, Malaquais and Voltaire to the Quai d'Orsay, passing the Austerlitz Sully, de la Tournelle, de l'Archeveche, an Double St. Michel, Neuf des Arts, du Carrousel, Royal and Solderino bridges. From the Pont Sully to the Petit Pont the underground construction will be a masonry arch, nine meters span, for a length of about 900 meters. From this point, for another 500 meters, the upper roadway will be carried by a metallic arch, and for the balance of the distance the masonry-arch construction will be resumed with a span of about eight meters.

About half way between the Place Valhubert and the Quai d'Orsay, between the Petit Pont and the Pont St. Michel, a station will be built, known as the station du Pont St. Michel. The Quai d'Orsay station—the terminal station—will be between the buildings of the Caisse des Depots et Consignations and the Palais de la Legion d'Honneur and between Pont Royal and the Pont de Solferino. It has been designed by M. Sabouret, chief engineer of the central service. The Orsay station will have 15 tracks, any one of which can be use for arriving or departing trains. According to the present plans, the three tracks nearest the river will be used for side tracks, the next four tracks for the long-distance departing trains, the next two for arriving and departing suburban trains, the next two for arriving long-distance trains, the next two for arriving and departing suburban trains and the last two for station service.

The platforms of the Pont St. Michel station will be 230 meters long. Those of the Quai d'Orsay station 185 to 240 meters long and six to seven meters wide. They are, of course, raised to the height of the footboard of the cars, so that these may be entered directly from the platform. The arriving traffic will come in from the Rue de Bellechasse and the Rue de Lille, and the departing traffic will be concentrated on the Quai d'Orsay. A number of elevators will be installed to facilitate movement of passengers and baggage. The rail level is 25 feet below the street level, and the company has not been obliged to purchase the title to the surface, the structure overhead being carried by a metal roof construction guaranteed by the company. The building above the station will probably be occupied by a large hotel and will, of course, be in harmony with the buildings in its vicinity. The designs of M. Laloux have been selected and approved by the minister of public works.

A short distance west of this station is the terminal station of the Ouest railroad at the Invalides, and still further west is the small station of the Champ de Mars, the former a part of the main line of the Ouest railroad, the latter an off-shoot from the Ceinture or belt line which encircles Paris. These stations will probably eventually be joined to the Quai d'Orsay station of the Orleans road, thus uniting the Ouest, Ceinture and Orleans systems.

In driving the underground tunnel, the Orleans railroad will operate without interference with the street traffic. The earth overhead will be supported by a metal shield pushed forward by hydraulic presses and followed closely by the masonry. The method is similar to that employed in building the great sewer recently laid down in Paris.

The operation of this underground road, as at present contemplated, is to be carried on by means of electric locomotives driven by continuous current at a pressure of between 500 and 700 volts, using the third-rail system of contact. In asking for estimates, however, the company has requested bidders to submit plans also for the use of systems of generation and distribution other than that just mentioned. The locomotives are to be eight in number, all alike, and able to haul a train of 250 French

(Continued on page 351.)

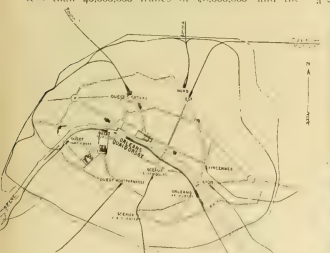


FIG. 1. HEAVY ELECTRIC RAILROADING PROPOSED IN FRANCE.—MAP OF PARIS, SHOWING PROPOSED EXTENSION OF ORLEANS RAILROAD.

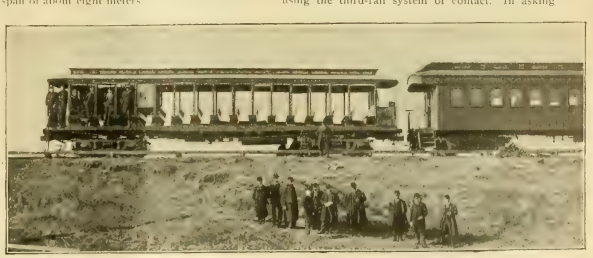


FIG. 2. HEAVY ELECTRIC RAILROADING PROPOSED IN FRANCE. GROUP OF ENGINEERS, ORLEANS RAILROAD AND MOTOR CAR OF TEST TRAIN ON TRACK.

DEVELOPMENT OF THE TELEPHONE FIELD.

Operating Telephone and Electric-lighting Systems in Conjunction.

By H. P. Clausen.

The time is rapidly approaching when managers of electric-lighting, street-railway and other electrical companies owning franchises giving them a right to construct and maintain electric circuits in the smaller cities of the country will take advantage of the rights thus vested in them and operate telephone sysems.

As a rule, electric-lighting companies in towns of less than 20,000 inhabitants find it profitable, though perhaps not always practicable, to shut down their plants during the hours of daylight, thus effecting a very considerable saving in the operating expenses. However, it should be remembered that there is an expensive system of outside construction work lying practically idle, and it is obvious that if it were possible to utilize the polelines for some other purpose than that of carrying the circuits which are in service only during the night, it would represent a marked improvement over the previous practice, and should result in substantial gain in the receipts of the corporation. Practically there are no serious objections to the advisability of operating the two systems under one management. The electric-lighting, street railway or power company's electrician could easily take care of the additional duties imposed upon him, and the company's force of linemen could be utilized to advantage, for the class of construction work that it would be absolutely necessary to maintain would occupy part time.

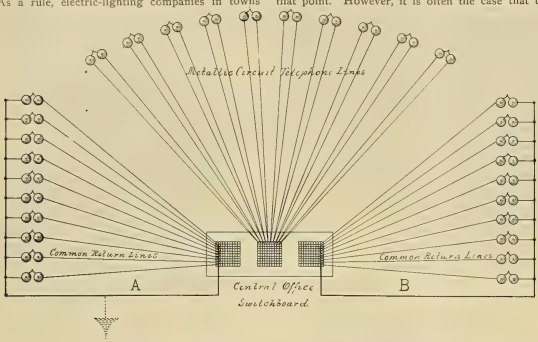


FIG. 1. OPERATING TELEPHONE AND ELECTRIC-LIGHTING SYSTEMS IN CONJUNCTION.

For the purpose of this paper the general details involved, let us say, that it is desired to operate a telephone system in connection with an electric lighting plant already installed. We will say that about 300 subscribers have been obtained, and that it is now necessary to proceed with the construction work required for connecting them to the exchange.

The central-office equipment of a telephone exchange need take up but a small amount of space. The operating room may be less than 12 by 16 feet, and if a storeroom be provided of about the same size, we have all the space that is necessary, as the wires, cables and other line material find a proper place among the same class of supplies belonging in the lighting plant storehouse.

The telephone exchange should be centrally located, of course, but unless the conditions are exceedingly favorable the switchboard should not be placed in the lighting plant, mainly on account of the large number of wires already terminating at that point. However, it is often the case that the lighting station is not advantageously located, and we may disregard the question of placing the telephone switchboard there.

When the central office has been given a fixed location we may consider the proper means for bringing the outside wires into the rooms assigned. The 300 telephones to be connected to the switchboard will require 600 wires, allowing two wires for every telephone. For practical reasons it is not advisable to run so large a number of wires into the exchange; therefore we must establish a convenient number of centers of distribution. Perhaps six or eight blocks away from the exchange a comparatively large number of telephone circuits come in from different directions, say a total of 150 circuits, which means 300 wires. Now, to extend all of these circuits to the central office it would be necessary to build a pole-line capable of carrying 30 10-pin cross arms, which for practical reasons cannot be considered. To avoid this multiplicity of wires at the exchange it is the usual practice to establish a center of distribution, and extend the line connections to the central office by means of aerial cables. It will not be necessary in this paper to discuss the well-known and practically standard principles involved in the construction of telephone systems, but only give attention to the special requirements that are met with when it becomes necessary to utilize pole-lines carrying electric-light wires for supporting telephone circuits.

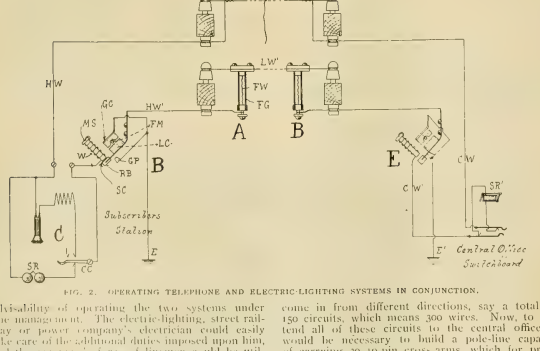


FIG. 2. OPERATING TELEPHONE AND ELECTRIC-LIGHTING SYSTEMS IN CONJUNCTION.

It has already been said that two wires would be required for every telephone circuit, and this is strictly true, where circuits are exposed to the influence of parallel wires carrying currents at more than 250 volts difference of potential. However, in districts where the telephone circuits are not exposed to such disturbing influences, a common wire may be employed, and with good success, providing, of course, a high standard of construction work is maintained. Nor is it advisable to place more than about 15 subscribers on one common return wire, because the least ground on any one of the wires might be the means of producing a disturbing influence on every telephone forming a part of that particular common-wire system. Thus, if we wish to operate 20 telephones on the common-return plan, it would be best to provide a common wire for each set of 10 telephones, and connect each set of common wires to a separate set of metallic circuit lines, as shown in Fig. 1. This plan of construction leaves the return wires entirely separate from each other, and a dead ground on the A system would affect only such telephones as are connected to the A common-return wire, or the metallic-circuit telephones connected to a telephone belonging to the A system.

Apparatus that will be required for protecting the telephone circuits against such extraneous currents as may result from proximity to dangerously charged wires may be divided into two classes, namely, high-tension current protectors and low-tension current protectors. The former class includes all protectors devised to guard against currents having a sufficiently high electromotive force to be dangerous to telephone apparatus. The operation of such protectors depends on the fact that a high-tension current will leap across a comparatively wide air gap, thus allowing it to be employed with good success for severing the telephone circuit.

Low-tension current protectors include all instruments intended to guard a circuit against the passage of a comparatively weak current; that is, a current which may be allowed to flow through a magnet coil for two or three minutes without doing any particular damage; however, after a lapse of four minutes the coil may become heated to a dangerous degree, and if then becomes essential that the telephone circuit be broken, thus allowing the magnet coil to return to its normal condition. This class of protectors generally depends on the opening of a circuit by an auxiliary wire coil, which is more quickly affected by the heating effect of a current than the telephone-magnet coil.

Referring to Fig. 2, the parts of a telephone circuit that require protective apparatus may be seen, P W renresenting a 500-volt street-railway feeder and L W and L W' respectively the unprotected and protected halves of a telephone circuit. As will be observed, the telephone circuit is metallic, whereas the 500-volt circuit serves as a path for currents that employ the earth return. Supposing we have a telephone circuit with both sides unprotected, as shown by L W, and a short piece of "dead wire" falls on L W and P W, it will produce a cross at C and C'. A few practical experiments will soon demonstrate that a cross with highly charged wires should be recorded and rendered harmless immediately. It should be remembered that the telephone circuit is really an extension of the 500-volt feeder, and thus the highly charged circuit can be extended to many other circuits under the central operator's charge. Such crosses should be discovered immediately and rendered harmless. The writer has a personal knowledge of many cases where telephone circuits were crossed with 500-volt feeders, the only evidence being furnished by the discovery of the offending piece of "dead wire." Frequently circumstances proved that the cross had existed for days, and the switchboard operator had unconsciously been dealing out currents, which, under other conditions, might have terminated fatally. How can such danger be overcome? Referring again to Fig. 2, the L W circuit is shown equipped with high-tension current protectors. A represents a simple fuse block with a connecting terminal at each end of a small hollow tube F G. These terminals are connected as shown to the line-wire and the house-wire H W. The line-wire and the house-wire terminals are connected by about four inches of bare copper wire F M, which will fuse open the circuit on the passage of about five amperes of current. At B we have a stationary and normally grounded piece of carbon G C, the line-wire terminal L C, the metal spool M S, around which is wound a quantity of wire W, and the grounded stop G P. As shown, the H W wire connects to the line terminal L C, then through the small piece of metal R B to the metal rod M S and wire W. F M is a small bar of easily heated metal pressed into the carbon block G C by means of a little dab of heated beeswax, which after cooling holds the metal bar in position and out of contact with the carbon block L C. It is understood, of course, that the carbon blocks are separated by a very small air-gap, being easily maintained constant by inserting a piece of perforated mica between the carbons. The space directly opposite the metal bar F M must not, however, be covered with the mica. This device, in combination with the fuse connection A, is placed on both wires and on both extremities of the tele-

phone circuit. In the event of a cross with a grounded or partially grounded circuit having over 250 volts difference of potential, the device is sure to serve its purpose, that is, severing at both ends of the circuit the fusible wire F W.

Supposing we have a properly protected telephone circuit and that a cross is had with P W at C and and C'. As stated before, the carbon blocks G C and L C are separated by a thin piece of perforated mica. In practice the distance is adjusted so that the 500 volts would immediately begin to arc across from carbon to carbon. The arcing quickly generates enough heat to melt the beeswax which holds the metal bar F M, thus allowing the bar to fall by gravity against the line carbon L C. This, when effected, throws a dead ground into the charged telephone wire, and naturally the fuse F W by blowing produces a four-inch air-gap between the line wire L W and the house wire H W. Similar action takes place at the exchange end of the circuit.

Telephone circuits can be protected against the passage of weak currents, say, somewhat over 0.15 ampere, by a device shown at B, Fig. 2. As will be noted, a current coming in over the wire H W passes through the soldered connection S C, to the wire W, and from it to the telephone support C C. The signal receiver S R is thus exposed to the probable damage a current of the requisite strength might produce. The operation of the protective device is as follows: During the passage of a current the wire coil W, which consists of many turns of very fine German silver wire, wound on the metal spool M S, quickly becomes heated, and in turn the metal spool M S becomes warm enough to weaken the soldered contact S C. Now the spring L C normally tends to pull the R B block of metal away from the stationary spool M S, and when the soldered contact S C loses its hold by reason of the heat imparted to it by the wire W and the spool M S, the L C spring succeeds in breaking the S C connecting point and grounds itself on the stop G P. Then, if the current exceeds five amperes, the fuse wire F W at A would open the circuit to earth, as already described.

The following passage is taken from a letter received by the writer in answer to an inquiry regarding the operation of an electric-light plant and telephone system conducted under one management: "I find that it is not good practice to use too many of the poles for electric light and telephone with a common-return system, but I think there will be no difficulty if the metallic system is used. The other work, I find, can be conducted together very economically and to good advantage. As to building pole-lines, I find it quite a help in overcoming the objections of the people, because we can compromise with them and get almost anything we want if we promise to use certain poles for both telephone and lighting systems and therefore reduce the number of poles in the street."

Illinois Telephone Association.

The annual meeting of the Illinois Independent Telephone association will be held at Mattoon on Thursday, June 9th, at 2 p. m., in the city court room.

As this is the second annual meeting of the association, the executive committee desires that no pains be spared to make it interesting. Mattoon is a very central railroad city, and is accessible from all parts of the state. For this reason it is anticipated that a large number of managers of independent-telephone exchanges will be in attendance.

To complete a state organization for any purpose is never a small task, and this is no exception, but the officers are glad to say that they have a membership of nearly one-third of the total number of the companies in the state, and hope to make it two-thirds in a short time, but it will depend largely upon the attendance at the meeting next week.

Some of the telephone manufacturing companies have applied for privileges to make exhibits, and no doubt it will pay operators to see them.

The officers of the association are: President, Dr. J. A. Lumpkin, Mattoon; vice-president, F. A. Brooks, Charleston; secretary, Albert M. Howell, Hillsboro; treasurer, M. Weinberg, Augusta. The executive committee is composed of Dr. J. A. Lumpkin, Mattoon; Albert M. Howell, Hillsboro; B. M. Burk, Carlinville; Miss A. M. McPhearson, Decatur; Dr. W. W. Tobey, Danville.

Automatic Service for Rochester.

Oliver Watson, representing the Automatic Telephone Service company of Buffalo, is endeavoring to secure a franchise from the city of Rochester and form a local company to introduce the system in the Flower City. Several instruments and a "switchboard" have been in operation in the city building for some time to give the city officials and the people an opportunity to investigate the merits of the system. Mr. Watson submitted to the council committee a draft of the franchise that the company desired, which contained the provision that all excavations of the streets and other necessary labor should be done in a manner satisfactory to the city, and that six telephones for the use of city departments would be placed free of cost and without expense for future service. If the franchise was granted the company agreed to put in a system for the accommodation of 5,000 instruments. The franchise provides further that the charges should not exceed $2.50 per month for residences and $3.50 per month for business places. The Bell company's charges are much higher.

Henderson Telephone Company.

The Henderson, N. C., Telephone company, which recently purchased the New Berne exchange, has about completed the installation of the new 200-wire switchboard, telephones, cables, lightning arresters and copper-return wire for that plant. The work has been under the supervision of General Superintendent F. G. Toepleman.

Everything has been so thoroughly overhauled that the system is practically new. The switchboard is one of the finest in the state, and is provided with every modern improvement for quick service. An increase of over 25 per cent. in the number of new subscribers since May 1st shows the public's appreciation of good service. The company is now getting material on the ground, and will at once begin the construction of new exchanges at Littleton, Weldon and Enfield, N. C., and will by fall have all its plants connected by all-metallic long-distance lines.

Solid Metal Receiver.

The accompanying cut illustrates the latest type of receiver imported by the Ericsson Telephone

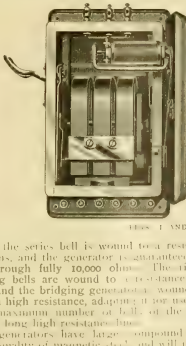
SOLID METAL RECEIVER

company of New York. It is a solid metal shell having the magnet fastened tight, with a rubber-insulated handle which protects it. Climatic changes will not affect the magnet. No adjustment is required, and the action is always positive.

The company's 1898 catalogue, which is now ready for distribution, will be sent out on application. The company manufactures and imports 60 different patterns of instruments.

Bridging and Series Bells.

In the accompanying cuts are shown (Fig. 1) the bridging and (Fig. 2) the series-magneto bells which the Western Telephone Construction company of Chicago is now introducing. The armature are of the softest grades of iron. The armatures are of large size, wound with ample amount of wire necessary to assure proper results. The automatic shunt is positive in action. Its operation requires no pushing of crank, and perfectly breaks the shunt circuit around the generator whenever the crank is turned, and thus assures certainty of operation of clearing-out drop when subscribers on lines connected ring off. Heavy cut gears are provided, which run smoothly and will last a lifetime. The call bells have centrally pivoted ringer armatures; the cores are of best annealed Swedish iron and the permanent magnets of best magnetic steel. The trunnion screws for armatures are provided with locking nuts to prevent working loose, and the armature is so arranged as to prevent its sticking against the pole-pieces. These bells have high coefficient of self-induction, and are very sensitive to influence of magneto current. The generator armature and bell magnets are wound with the best quality of silk-covered wire.



FIGS. 1 AND 2. BRIDGING AND SERIES BELLS

The automatic hook switch is the regular Western type. The springs are all made of finest quality of German silver, are long and flexible. An anti-friction shoe is placed on the lever to prevent any wear between it and the mainspring. Contact points are of platinum.

The bell box is made of selected quartered oak, walnut and cherry, finely polished and finished, with nickel-plated trimmings. It will accommodate a long-distance type of induction coil. The back of bell box is extended above and below the box proper, so that the bell can be screwed on to its support from the outside. Outside binding-posts of substantial design are provided for connection of receiver-cord tips and primary and secondary transmitter circuits. The sides of the box are of heavy material, and the generator is firmly screwed in position.

Lightning arrester plates are arranged so that incoming lines can be grounded on either side of the bell. All connections are soldered, and the slotting and wiring is neat. The magnets are enameled with the best grade of red enamel and have nickeled and polished trimmings.

H. C. Dodge, the general manager of the Western Telephone Construction company, says the new equipment has been highly commended by experts in exchange work and that there is already a considerable demand for the new type.

Telephone Extension in Utah.

A. J. Vance, a Utah telephone man, has been lately investigating the telephone prospects in Sanpete county in that state. He is contemplating the feasibility of building a line from Manti, the county seat, through the various intermediate villages to Nephi, Juab county, 75 miles south of Salt Lake City. At Nephi connection with the long-distance system would be had. If the Rocky Mountain Bell company has discontinued operations in Sanpete county permanently, Mr. Vance says that his company will proceed at once with the construction of the line.

Progress in Minnesota.

The Minnesota Central Telephone company has nearly completed its lines to Minneapolis, and expects to establish toll stations and be ready for business about June 15th. The main line of 55-foot poles is finished in the city, and the company is stringing copper wire as far west as Litchfield, which will give it a metallic circuit from Willmar to Minneapolis. The company is also arranging to string copper wire in other directions from the city, and will be connected with St. Paul about the first of July. It proposes to build a line from Minneapolis to Aberdeen, S. D., too, and when the different lines are completed, it will have, in connection with the other companies comprising the Western Electric Telephone system, what is said to be the most complete independent toll-line system in the Northwest, comprising about 5,000 miles.

The Sunset Telephone company is rebuilding lines out of Pomona, Cal., and will shortly rebuild the system in that city.

WAR NEWS.

Cable-cutting Operations.—In the last issue of the Western Electrician the cable cutting by the auxiliary cruiser St. Louis at Santiago and San Juan was briefly alluded to. On May 28th the St. Louis arrived at her home port—New York—and Captain Randle, the navigating officer, gave further details of the cable-cutting attempts in which the ship had participated. According to the newspaper account of the captain's story, the St. Louis left St. Thomas on May 13th, scouting along the north coast of Porto Rico and stopping a few miles east of San Juan to grapple for the cable connecting that place and St. Thomas. This cable was successfully caught and parted. On the 16th the St. Louis and the government tug Wampatuck made an unsuccessful attempt to cut the cables at Santiago. Two days later another effort was made at the same place, with a greater degree of success. A cable was picked up and about 100 fathoms cut out. This section was retained on the St. Louis and taken to New York. On May 19th the two vessels proceeded to Guantanamo to cut the Haytian cable. This cable was grappled by the men on the little Wampatuck, but a Spanish gunboat caused the tug to retire, although Captain Randle says that he believes that the efficiency of the cable was destroyed. At Santiago there was a sharp exchange of shots, but neither at that place nor at Guantanamo was any American injured, and the damage to the vessels was but trifling. After parting company with the Wampatuck on the 20th, the St. Louis went again to Porto Rico, arriving off Cape Rojo, the southwestern corner of that island, on the 22d. Here an effort was made to grapple with the cable connecting Porto Rico with San Domingo and Jamaica. The captain says that "after nearly a day of patient work we found that the grapplings would not hold in the foul bottom. We believe that we broke this cable, and the absence of information over it tends to confirm our opinion." "How many cables were cut in all?" asked the reporter. "Three," said Captain Randle—"the one north of Porto Rico connecting with San Domingo, the cable at Santiago de Cuba, connecting with Jamaica, and the line at Guantanamo, running to Cape Haytien, Hayti."

However, it is still very doubtful whether the cable connection between Cuba and Kingston, Jamaica, has been cut off. Duplicate cables connect Santiago and Kingston, and both would have to be cut to stop the sending of messages. Again, the cable between Santiago and the island of Hayti, via Guantanamo, was reported to be in working order as late as May 26th. It is suggested as a possibility that some of the cables cut in West Indian waters during the present war were only dummies laid for such deception. This ruse is not new, but it cannot easily be detected. It was worked successfully many times during the last war between Chile and Peru.

The Signal Service.—Captain John R. Bartlett, United States Navy, superintendent of the coast signal service, reports that a complete system of observation is established along the entire Atlantic and Gulf coasts of the United States, and that the coast signal service is thus fully in operation. This is effected through the co-operation of the keepers of all lighthouses, crews of the life-saving stations, observers of the Weather Bureau and connection by telephone and telegraph wires of the several serivces and the Western Union telegraph to the headquarters of the Navy Department at Washington. It is believed that it would be impossible for a Spanish ship or fleet to come within dangerous proximity to the Atlantic or Gulf shore without being reported to Washington as well as to the nearest military or naval depot. A very important adjunct of this service is the patrol by the crews of the life-saving stations along the coast, filling in gaps between lighthouses and coast signal stations. Captain Bartlett has called attention to the fact that under existing laws the crews of life-saving stations will be "laid off" during the most of June and July. The coast signal service would be greatly crippled thereby. The coast signal service is of such importance, that in order to maintain its efficiency Secretary Long earnestly requests that immediate steps be taken to obtain the necessary authority of law to have the crews of the life-saving stations, or half crews, kept on during the war. A special act of Congress, with an extra appropriation making provision for pay of crews, will be necessary.

Miscellaneous Notes.—In the work of mining the harbor of San Diego, Cal., expert volunteer electricians, under command of Lieutenant Meyler, U. S. A., were employed. Each man was required to take the following oath: "I solemnly swear that I will bear true allegiance to the government of the United States of America, and will support the constitution thereof, and that I will not under any circumstances, either directly or indirectly, divulge or impart to any person or persons anything which has, or may hereafter, come to my knowledge relating or appertaining to the torpedo sysitem or submarine mines which are now or may hereafter be placed in the harbor of San Diego, Cal.; nor will I communicate to any person or persons any knowledge or information which I now have, or may hereafter acquire, in reference to the fortifications of said harbor, or the defense thereof. This oath is taken freely and voluntarily, and without any mental reservation or secret evasion whatever, and to the faithful performance of which I pledge my sacred honor, so help me God."

A detachment of regular-army engineers from the battalion having headquarters at Willet's Point, near New York, has arrived in San Francisco to go with the second expedition to Manila. The command consists of 60 men, under Capt. William C. Langfitt, First Lieutenant Charles P. Echols and Second Lieutenant William D. Connor. The detachment took along a complete engineering outfit. This included picks, shovels, spades, transits, levels, a pontoon train of canvas boats and all tools necessary for making and planting submarine mines and torpedos. The material for making the mines, junction boxes, cable and electric batteries will be obtained in San Francisco. Captain Langfitt said he had no notion of what work his command would be expected to do on its arrival in Manila, but his men were ready for any work that army engineers can do.

Mr. Chandler has introduced a bill in the United States Senate authorizing the secretary of the navy to establish and maintain all such telegraphic communication as he may deem necessary during the continuance of the present war by opening or reopening such ocean lines as may be necessary in any exigency for the proper protection of naval and military operations. The bill carries an appropriation of $1,000,000.

Julius Buerstaette of Manitowoc, Wis., has left the electric-light company of that city to accept a position as electrical engineer on one of the United States warships. His patriotism costs him a financial sacrifice, for his salary is only half what he was receiving from the electric-light company.

The New York Sun states that some surprising schemes for winning money or fame have been developed by the war with Spain. The promoters bombard the departments with letters and besiege officials for personal interviews. Several concerns that run electric stereopticon shows have applied for permission to put photographic plants on American ships of war, from Porto Rico to the Philippines. They offer to take chances on having their operators killed in engagements and to waive any claim against the government in case any of them should get maimed or killed. The naval authorities, in their consistent and praiseworthy effort to be courteous and civil to all hands, have endeavored to repulse these concerns by informing them that there isn't room on any of the ships for their plants. But this way of putting it is not satisfactory to the concerns, which reply that their operators are men inured to hardship, can live anywhere aboard ship, and can conduct operations from barges or launches towed by the warships, for the matter of that. Another company of the same sort has been making the army officials wretched since the mobilization of state troops began, with appeals that its operators be permitted to accompany the armies that are to invade Cuba and the Philippines. This company also nobly waives the right to claim indemnity from the government in case any of its operators should get the worst of it while members of the expeditions, and it states, besides, that it stands ready to secure as operators men who are immunes from yellow fever, beri beri, elephantiasis, or any other of the ills that the alarmists ascribe to the tropics. Moreover, the company will generously pay the government for the transportation of the operators and their luggage and apparatus. This company has been informed that its men cannot go as members of the army expeditions.

The following "press item" sent out by the Westinghouse company has an especial interest at this juncture: "Even Spain shares in the general rush for American electrical machinery. The Westinghouse Electric and Manufacturing company, through its London representatives, has installed one of its 135-kilowatt, single-phase, separately excited alternators, belted to a Westinghouse engine, for the Malaga Electricity company of Malaga, Spain. The decay of Spain's power might be traced largely to the absence of engineering ability among her indolent population. She cannot build her own machinery, and in most cases she is unable to operate it when it is built. The ambitious youth of the present day comes to America to study engineering, realizing that the field in his country is by no means overstocked. Meanwhile, American enterprise is installing American systems and American methods in Spain."

Captain J. E. Brady of the Signal Corps is the new press censor at Tampa. He is said to be an expert telegraph operator, a former newspaper man, and able to speak Spanish fluently. Captain Brady insists on strict adherence to the letter and spirit of the government censorship. Among other precautions he is said to have warned railroad telegraphers from discussing military operations over the wire.

A board of officers to consist of Col. George L. Gillespie, Corps of Engineers, and Eugene Griffin of New York, who was recently appointed colonel of the First United States Volunteer Engineers, has been appointed to meet in New York, at the call of the senior member, to examine applicants for commissions in the First Regiment United States Volunteer Engineers. Candidates for commissions will be ordered before the board from time to time by the War Department.

Among those officers of the Chicago naval reserve who have passed the examinations imposed by the navy for officers' places and have been recommended by Commander Hawley for commissions in the navy is Lieut. S. D. Flood, a former well-known electrical man.

F. B. Badt of Chicago has tendered his services to the government in the present war with Spain. His experience in the Prussian army, where he held the rank of first lieutenant, and his knowledge of engineering should prove valuable at this time.

Heavy Electric Railroading Proposed in France.

[*Continued from page 331.*]

tons in seven minutes between the stations of the Quai d'Orsay and the Pont d'Austerlitz without stopping at the intermediate station of the Pont St. Michel. This means a speed of 45 kilometers an hour. The locomotives should not only be able to haul a train of the weight mentioned on a grade of 11 millimeters and on curves of 200 meters radius, but should also be able to haul trains as heavy as 300 tons at a slower speed. The locomotives must be built to move in either direction at the same speed, and be of a length to allow them to be turned on turn-tables six meters 20 centimeters in diameter. They are to be equipped with motor-driven air pump and air brakes.

The electric generating station will be placed at the western end of the Valhubert station departing platform, taking the place of certain waiting rooms. The equipment is to be of sufficient capacity to allow of the simultaneous movement of four 200-ton trains, exclusive of the locomotive, upon the line—one starting from the Austerlitz station, one from the Quai d'Orsay station, the third climbing the grade of 11 millimeters, and the fourth running between the Pont St. Michel and the present main station. Furthermore, the generating plant must include sufficient lighting capacity for three stations already mentioned, and the tunnel, as well as for the station and shops at Ivry. The current is to be taken by the locomotives from an insulated third rail at the side of the track in the stations and between the tracks over the rest of the line, due provision being made for all switches and cross-overs.

In order that a better knowledge of the operation of electricity in heavy traction service might be gained than was possible in Europe, the Orleans company recently sent over to America a corps of engineers to investigate the different electric-railway installations of this type in this country. The party was headed by M. E. Solacroup, assistant chief engineer of material and traction, and M. Sabouret, already mentioned; the other members being Messrs. Riberty, Fremenville and Walton. Their inquiries were conducted very quietly, but during their short stay they were able to visit almost every installation of special interest to them in the United States.

The investigation was begun at Hoboken, where an electric locomotive is hauling all the freight service between the trans-Atlantic docks there and the West Shore and Erie railroads. From there they visited Baltimore to inspect the great electric locomotives which operate the entire traffic of the Baltimore and Ohio railroad through the belt-line tunnel in that city. From Baltimore they went to Chicago for the purpose of observing the operation of the electric elevated railroads, and, returning East, passed through Cleveland, Niagara Falls and Buffalo, where they had an opportunity of studying the employment of the electric car in high-speed interurban service.

From Buffalo they traveled to Boston, where they were met by C. P. Clark, president of the New York, New Haven and Hartford railroad, and Col. N. H. Heft, chief electrician of the same road. They traveled over the Nantasket Beach branch of the New Haven system, between East Weymouth and Hull, and inspected the power house. Returning, they visited the third-rail electric system between Berlin and Hartford, Conn., opened for traffic last summer, and rode on the 30-ton electric locomotive operating between factories at New Haven and the Cedar Hill Junction.

A special test was arranged for their benefit at Schenectady on the experimental two-mile track of the General Electric company, the conditions of the track and load being, as far as possible, similar to those which will obtain on the line in Paris. A length of track 1.11 miles long, corresponding to the distance between the Quai d'Orsay and the Pont St. Michel stations, the most difficult portion of the proposed Orleans extension, was marked off. According to the time schedule arranged for the operation of the road, this distance should be covered in three minutes and 50 seconds. A train was made up of a motor car of the Nantasket Beach pattern equipped with four "G E 55" 175 horse power motors, several New York Central coaches and seven flat cars loaded with pig-iron, making a total trainload of 320 tons, including the motor car, which weighed 45 tons. The run between the marking flags, including starting and stopping, was made easily in three minutes and 25 seconds, giving a margin of not less than 25 seconds.

The question of rendering the third rail innocuous after the passage of the train having been brought up, the General Electric company arranged an ex-

hibition of its method of effecting this result. A section of the third rail was measured off and divided into sections in lengths varying from 30 to 500 feet. Connections were made between these and a system of automatic switches, and the conditions of the General Electric system of surface contact almost exactly reproduced. By this system the arrangement of circuits is such that the sections into which the rail is divided may be of any length from that of a few feet to any number of miles; that is, any section of the conductor rail will be alive only when the train itself is running over that section. The instant the train passes to the succeeding section, that which it has just left becomes dead and absolutely innocuous. The use of this system also renders it possible to "section" the conducting rail at stations, leaving it continuously alive at all intermediate points. The switch cutting the dead section into circuit is closed as the contact-shoe of the train comes into contact with the conductor, energizing it, and is automatically opened as the train passes to the next dead section.

The motor car was run over that part of the track beside which the third rail was sectioned, and, as a visual means of indicating that the third rail was alive, a number of incandescent lamps on the top of the boxes containing the switches were connected to the conductor. As the car reached the sections and rendered them alive, the lamps lighted up, being extinguished as the contact-shoes passed over the dividing lines between the different sections.

These tests formed the subject of the concluding investigations of the French engineers in this country. A few days before their departure a dinner was tendered to them at Delmonico's, at which many prominent railway engineers and electricians were present to meet them. They admitted having received many new ideas during their stay, and return to France convinced of the use and possibilities of electricity as a motive power, especially in the field of heavy traction.

In Fig. 2 is shown a group of engineers, including the visiting Frenchmen. The picture was taken at Schenectady, and the motor car of the test train is shown on the trial track.

Insulation of High Voltages.

A dispatch from Marysville, Cal., to the San Francisco Chronicle, dated May 13th, says: "An experiment concluded here by Dr. F. A. C. Perine of Stanford University for utilizing the electric power line of the Yuba Power company from its power house to Brown's Valley, a distance of 10 miles, has resulted in demonstrating that 36,000 volts may be transmitted over a copper wire using glass insulation, against 16,000, which has been the maximum in practice in power transmission heretofore. The result of the experiment will be to effect a saving of half the cost of wire in the construction of electrical-transmission plants in future. As it is now, the cost of wire is about half the entire cost of a plant. The exact loss in the transmission of this high current has not as yet been made known."

New York Electrical Society.

The annual meeting of the New York Electrical society was held at Madison Square Garden on May 26th. The following-named officers were elected: President, Gano S. Dunn; vice-presidents, Willard S. Case, H. B. Coho, Dr. C. A. Doremus, F. A. Pattison, E. E. Higgins, Charles Blizard; secretary, Geo. H. Guy; treasurer, H. A. Sinclair. The treasurer's report shows that the society is in a prosperous condition. According to the secretary's report, the membership last year was 397; there have been 215 members elected this year; there have been four resignations and one death. There are now 607 members in the society. The number of new members elected at the annual meeting was 37.

Omaha Exposition Open.

The Trans-Mississippi and International Exposition at Omaha was formally opened on June 1st. President McKinley, in Washington, "touched the button" to start the machinery and also sent a congratulatory message which was read by the governor of Nebraska to an audience of 6,000 persons. There was a parade, several addresses, a luncheon for the distinguished guests and felicitations generally. The exposition is on a scale of greater magnitude than many visitors anticipate and is said to make a very favorable impression. It will be open until November 1st.

Anchor Electric Company's Affairs.

A decree for the plaintiff has been ordered by the full bench of the Supreme Court of Massachusetts in the case of the Anchor Electric company of Boston against Horatio C. Hawkes. The plaintiff, in seeking to carry out an agreement made by Mr. Hawkes, asked for an injunction to restrain him from interfering or competing with it in its business for a period of five years from September 29, 1894. Though the agreement was not limited as to territory, and the plaintiff's business extends over the whole country, the court holds that it is a valid agreement, going no further than is reasonably necessary for the protection of its business, and is not void as in restraint of trade.

The agreement was made upon the sale by the defendant of his interest in the Hawkes Electric company and the consolidation of this company with the Iona Manufacturing company and the Brown Electric company, by the formation of the Anchor Electric company. All officers of the old companies signed the agreement, and the court holds that it went no further than was reasonably necessary to protect the good will of the defendant's corporation, and is enforceable against him.

City Telegraph Superintendents.

The third annual convention of the Fire and Police Telegraph Superintendents and Municipal Electricians will be held at Elmira, N. Y., on August 9th and 10th. Members are expected to bring their wives, as special arrangements are being made for their entertainment. Several papers will be read by well-known electricians. W. Y. Ellett is president and H. F. Blackwell secretary of the association.

Four-cent Fare Defeated.

Judge Seaman in the United States Court at Milwaukee on May 31st decided the four-cent fare case of the city of Milwaukee against the Milwaukee Electric Railway and Light company in favor of the street-railway company. The case involved the validity of the ordinance to compel the street-railway company to sell 25 tickets for $1. Judge Seaman pronounced the ordinance illegal. The case will probably be appealed to the United States Supreme Court.

The decision does not touch upon the question of the right of the city to regulate the fares of the street railway company. It simply decides that in the case of the Milwaukee Electric Railway and Light company it could not earn a dividend commensurate with its investment upon a four-cent fare. It also holds that a five-cent fare is not an excessive charge and is just.

CORRESPONDENCE.

New York Notes.

New York, May 31.—A dispatch from Albany states that the Metropolitan Street Railway company and the Third Avenue Railroad company have made application to the railroad commissioners for permission to change their motive power on all their cable lines to that of the conduit system of electrical propulsion. The Metropolitan has also made application to change the motive power on its horse lines to the same system or to compressed-air propulsion. Hearings will be given by the commission on these applications on Thursday at the Fifth Avenue Hotel in this city.

These coincident applications are considered significant of a possible consolidation of all the important surface-railroad interests in New York, or at any rate in the borough of Manhattan. The Metropolitan and Third Avenue companies are now working together harmoniously, whereas until this year the two corporations were at swords' points. In addition, it is said that a working arrangement between the Manhattan Elevated company and the surface roads is a further possibility. It is reported that an attempt was made some months ago by the Metropolitan capitalists to make a deal whereby an exchange of stock or some similar undertaking would enable the two roads to be operated jointly, with a material saving to both. That deal fell through because neither Mr. Gould nor Mr. Sage would listen to anything but a cash transaction. But it is believed that since that time a satisfactory plan of action has been agreed upon. A working agreement with the Brooklyn roads is also hinted at. Altogether, the financial men of the city are looking for important developments in the transportation situation in New York, although the officers of the companies continue to deny that consolidation is under consideration.

At the office of the Metropolitan Street Railway company it is stated that as soon as possible after the hearings by the commission work will be begun toward establishing complete interchangeability on all of its lines. The general motive power is to be that of the underground electrical system, but experiments will be made with the compressed-air system on some of the short crosstown lines. The extent to which air motors will be used will depend on the results of the tests. "We are entirely satisfied with the results of the electric system now in use," said an officer of the company to a reporter. "All of the defects were developed and remedied on the Lenox avenue line, where the system was first tried. The first car run on the Fourth avenue electric line made as good time as the cars now running. The lack of interchangeability, by which is meant the inability to take passengers from one end of the line to the other, or to points east and west, without transferring them, is a serious inconvenience. Our idea is to make a universal and standard line all over the city. Nearly seven hundred and eighty million transfer tickets were given out last year. While this cannot be entirely overcome, we intend to reduce it considerably. The compressed-air method of propulsion has one distinct advantage—cars thus propelled can go anywhere that tracks are laid. The great difficulty which confronts the street railway company is the fact that while our acreage is constantly increasing, the trackage is limited. It is impossible, for example, to lay more tracks on Broadway, but every time an old building is torn down and a sky-scraping office building goes up it adds a large number to the persons who use the line at certain hours every day. By eliminating the slower method of propulsion in use on some of the lines the congestion will be somewhat decreased, but the carrying of 600,000 passengers daily is a subject which continually presents new difficulties."

In the suit of the minority stockholders for a permanent injunction restraining the majority stockholders of the Kings County Traction company from sellng the asests of the company, Justice Barnard of the Supreme Court has granted the motion to contine the injunction pending a trial on the merits of the case. The trial will be had before Justice Maddox in the Special Term of the Supreme Court in Brooklyn.

Three new street-railroad companies have applied to the State Railroad Commission for permission to construct roads in New York. The North End Street Railway company, with a capital of $5,000,000, wants permission to construct a road 13 miles long, with termini at the intersection of Manhattan avenue and One-hundred-and-sixteenth street, and at the intersection of Kingsbridge road and the northerly line of New York city, with numerous branches. The Fort George and Eleventh Avenue Railroad company, with a capital of $10,000, seeks authority to construct a road 1,500 feet long on Eleventh avenue, between Kingsbridge road and One-hundred-and-seventy-fifth street. These two roads are backed by the Metropolitan Street Railway company. The Kingsbridge Railway company, with a capital of $1,000,000, desires permission to construct a road about eight miles long from the intersection of Manhattan street and the boulevard running along the latter thoroughfare to Kingsbridge road, and from the junction of Amsterdam avenue and Kingsbridge road, connecting with the existing road, or Amsterdam avenue, at One-hundred-and-sixty-second street, thence along Kingsbridge road to and upon the Harlem ship-canal bridge, and over the proposed bridge across Spuyten Duyvil Creek to the northernmost point of intersection of West Two-hundred-and-thirtieth street with the Kingsbridge road, thence along Two-hundred-and-thirtieth street to and along Riverdale avenue to the city line. This road is to be a connection of the Third avenue line.

Attention is directed to a decision of the Court of Appeals, rendered on May 10th, which will bring about an extraordinary change in the law of this state relating to the obligations of railroad companies to their passengers, unless the court upon a reconsideration of the questions involved abandons the rule laid down on that occasion. Xavier Stierle sued to recover damages from the Union Railway company of this city for personal injuries suffered by him while a passenger on one of the defendant's street cars. The plaintiff alleged that he had been thrown from the car because it was "suddenly, negligently and carelessly driven around a curve in the track upon which it was being moved over a switch." There was conflicting proof as to whether the accident really occurred through the negligence of the employes of the railroad company in managing the car or by reason of negligent conduct on the part of the plaintiff himself in attempting to alight while the car was in motion. Accordingly, the judge told them that "in respect to carrying passengers a railroad company is bound to exercise all the care and skill which human prudence and foresight can suggest to secure the safety of their passengers." The Court of Appeals, by a vote of five judges to two, has declared it to be erroneous. "The obligation of carriers of passengers," says Judge John Clinton Gray, who writes the prevailing opinion, "to exercise the highest degree of care which human prudence and foresight can suggest, only exists with respect to those results which are naturally to be apprehended from unsafe roadbeds, defective machinery, imperfect cars, and other conditions endangering the success of the undertaking." In the case under consideration the plaintiff, if his story be true, was injured by reason of the negligent manner in which the driver attempted to take his car over the switch and, under such circumstances, say the majority of the Court of Appeals, "the defendant was only liable for the failure of the driver to use that skill and care which would be required of an ordinarily careful and prudent man."

This doctrine, which, by the way, is directly opposed to all previous rulings, including those of the Court of Appeals itself, is not generally accepted. Judge Roger A. Pryor disputed its correctness in the Court of Common Pleas, and Judge Denis O'Brien and Judge Irving G. Vann dissented in the Court of Appeals on the ground that "the reason which requires the highest degree of care by a carrier of passengers with reference to roadbed and machinery extends with equal force to the use of the roadbed and machinery in the operation of cars. There should not be a higher degree of care required in providing appliances than in using them."

It is pointed out that the views of the dissenting members of the court are in harmony with the law as declared by the Court of Appeals itself more than 30 years ago, in the case of Maverick against the Eighth Avenue Railroad company, and re-

peatedly laid down since then. In the Maverick case the accident had absolutely nothing to do with any defect or imperfection in the road or car, but the passenger was injured in consequence of the negligence of the conductor in stopping the car so that it collided with a hook and ladder truck; yet the Court of Appeals unanimously held that the defendant was subject to the rule that "passenger carriers bind themselves to carry safely those whom they take into their coaches, so far as human care and foresight will go," and because the conductor failed to exercise that degree of diligence in the operation of his car, the verdict against the railroad company was sustained.

In the case of Coddington against the Brooklyn Crosstown Railroad company, also presented in the New York reports, it is shown that the accident occurred by reason of the negligence of the driver of a horse car in crossing the line of a steam railroad as an engine came along and struck the car. Here, also, the fault of the defendant was not in failing to provide a proper car or proper appliances, but in failing to use the car carefully with reference to the safety of the passengers, and the Court of Appeals, speaking through Judge Robert Earl, reiterated the familiar rule in these words: "That under such circumstances the defendant was bound to use the highest degree of care and prudence, the utmost skill and human foresight, is the settled law."

This new ruling, however, will tend to unsettle things, and if it be finally adhered to it will doubtless prove of great benefit to street-railway companies.

M. S.

PERSONAL.

Lyon Playfair, the well-known English chemist, is dead.

Dr. Charles E. Emery of Brooklyn, the eminent mechanical engineer, is critically ill. Dr. Emery is a highly esteemed member of the engineering profession, and his western friends will unite in a cordial hope for his recovery.

Russell Stanhope, the vice-president and secretary of the St. Louis Electrical Supply company, will shortly make a European trip. Mr. Stanhope sails for England on June 8th, and will, in all probability, be in that country and on the continent about two months. Mr. Stanhope is an Englishman, and will take this opportunity of visiting his old home. He expects to return to America.

ELECTRIC LIGHTING.

Bids will be received up to 8 p. m., June 13th, for purchase of Reno (Nevada) electric-light bonds amounting to $20,000, or any portion thereof; also proposals with plans and specifications, to construct and establish an electric-light plant for the city of Reno.

The Common Council of Lockport has entered into a contract with the Lockport Gas and Electric Light company to light the city for three years. The contract provides for 250 electric lights and 96 gas lamps. The price for each electric light is to be $78.

A meeting of the Redlands (Cal.) Electric Light and Power company has been called, to be held July 21st, for the purpose of considering and voting upon the question of increasing the capital stock of the incorporation from its present sum of $200,000 to the sum of $500,000, and also for voting on the question of increasing the bonded indebtedness of $100,000 to $400,000.

Of the 2,986 vessels which passed through the Suez Canal last year, 2,837 employed the electric light for navigating during the night. As a result of this increased use of the electric light the mean duration of passage for all vessels passing through the canal shows a constant and satisfactory decrease. Last year the average duration was only 17 hours 44 minutes, against 18 hours 38 minutes in the previous year, and in 1897 the percentage of vessels navigating by night was 95 per cent., against 94 per cent. in 1896.

The subject of street lighting is interesting Geneva, N. Y. The Common Council of that city rejected bids of the Welsbach Gas company and the Geneva Light and Power company. The bid of the Geneva Light and Power company was as follows: Eighty-five arc lights, 2,000 candle power, every night in the year, three-year contract, $97.50 per light; same number of lights, five-year contract, $95; three-year contract, 325 nights a year, $92.50; five-year contract, $90; three years from and after May 1st, 100 arc lights, every night, to 4,000 hours, at $.02325 per light per hour.

A call has been made for a small electric plant for lighting the dredges engaged in searching the beds of the rivers of the South Island, New Zealand, for gold, which is now a successful industry and promises to extend in the future. The plant required is that of a dynamo capable of supplying two lights of 1,500 candle power each, one of 500, two of 200, and one of 100, making a total of 4,000 candle power. The main lights would swing from 75 to 100 feet from the dynamo, and the others with an average length of 50 feet. Special stress is laid upon the need for small floor space, simplicity of construction and ease of manipulation. Some inquiries have already been received from the United States. The price quoted should be for the apparatus complete and ready to operate.

ELECTRIC RAILWAYS.

The franchise for an electric railroad from Los Angeles to Whittier, Cal., has been granted to A. B. Patton.

The franchises, rolling stock, plant, etc., of the Pasadena and Los Angeles Electric Railway company have been sold to Don C. Porter of Pasadena, acting as a representative of the reorganization committee, for $150,000.

The Indiana Gas Belt electric railway was put in operation on May 28th, between Anderson and Summitville and Marion and Fairmount, leaving but five miles to connect up to complete the Marion-Anderson line. The Elwood line is well under way, and the Muncie line will be started at once. The Indianapolis branch will be built this year or early next spring. This is Indiana's first electric railway, and when completed it will be one of the longest systems in the country, covering over 100 miles. The equipment is high class. Congressman Henry is at the head of the system.

It is said that at the meeting of the Chicago City Council on June 6th a 50-year franchise for a new South Side overhead trolley street-car system will be asked by the Union Transit company. Beginning at Jackson boulevard and Pacific avenue, and continuing through 20 miles of streets to the terminal at Sixty-seventh street and Woodlawn avenue, the proposed right-of-way covers the territory now occupied by the Chicago City Railway company. The Union Transit company is said to have been incorporated a year ago with a capital of $500,000. It is said that Lucius Clark, who is reported to be its president, has been quietly working, and has secured frontage consents along the right-of-way.

The Manchester, N. H., street railway has passed into the hands of Tucker, Anthony & Co. of Boston. It is 14 miles long and last year netted $12,000 above expenses, paid five per cent. on its bonds and a nine per cent. dividend. The new directors are W. A. Tucker of Boston, president; P. L. Saltonstall of Boston, Walter M. Parker and Charles T. Means of Manchester and E. P. Shaw of Boston. Messrs. Tucker, Anthony & Co. also own the Manchester Electric company, which does a gross business of $125,000 a year and furnishes electric power to the street railway. Mr. Saltonstall is president of the electric company and W. A. Tucker treasurer. It is proposed to consolidate the companies.

Articles of consolidation of the Pasadena and Pacific Railway company of Arizona and the Pasadena and Pacific Railway company of California were filed last month in Los Angeles, Cal. The two companies which have thus been merged into one will be known by the name of the Los Angeles-Pacific Railway company. The original electric road to Santa Monica by way of Sherman, and now known as the "old line," was built by the Arizona company. Later a company was incorporated by the same interests under the laws of California, and built the "new line" by way of University and Rosedale, both companies were controlled by the same men and their consolidation is merely a legal step and does not mean that there has been any change in the management of the road.

The Bluff City electric street railway has been sold to a new corporation, the Chicago and Milwaukee Electric Railway company, which proposes to complete the construction and equipment of the road. The directors are George A. Ball, A. C. Frost, George M. Seward, F. S. Reeves and C. E. Loss. Mr. Ball is president, Mr. Frost vice-president and treasurer, and Mr. Seward secretary. The new company has a capital stock of $1,000,000, and it will execute a mortgage securing an issue of $1,000,000 bonds. It is estimated that it will cost $750,000 to complete the road, which will then be 35 miles long. Work is in progress between Waukegan and Highland Park, and 4.4 miles are in operation between Waukegan and North Chicago, and four miles between Highland Park and Fort Sheridan. The stretch between Highland Park and Waukegan will, it is expected, be completed in about 60 days, while the plans provide for the extension of the line to Evanston by October 1st.

The Buffalo and Lockport Railway company has been incorporated to operate an electric road from Buffalo to Lockport, N. Y. The capital stock of the company is $1,000,000. The length of the proposed road is to be 29½ miles, and the principal office is to be located in Pendleton Center, Niagara county. The directors named for the first year are as follows: Hon. W. Caryl Ely and Hon. Frank A. Dudley of Niagara Falls; Robert L. Fryer, H. J. Pierce, G. H. Dunbar and Burt Van Horn of Buffalo; John A. Merritt, S. Curt Lewis and Frank M. Ashley of Lockport. The board of directors has organized by electing Hon. W. Caryl Ely president, Henry J. Pierce vice-president, Burt Van Horn secretary-treasurer and general manager. The company's line will commence at the center of Hertel avenue and Virgil street in Buffalo, run along Hertel avenue to Kenmore avenue, to Delaware street, Tonawanda, to Young street, to Delaware street, across the Ellicott Creek, Erie Canal, Tonawanda Creek, to Main street, to Sweeny street, to the Tonawanda-Lockport branch of the Erie road, which tracks it has leased and will use to Lockport, where it will be connected to the lines of the Lock City road by a switch at the corner of Main and Transit streets.

TECHNICAL SCHOOLS.

In announcing the plan of instruction for the summer quarter, the West Virginia University of Morgantown, W. Va., does not neglect the engineering students, as courses on physics, chemistry, geology, civil and mining engineering, mechanical engineering and mechanic arts and applied mathematics are provided. William S. Aldrich, M. E., is the professor of mechanical engineering. The summer quarter will begin on July 1st and continue 12 weeks. It is not a "summer school," but is an integral part of the work of the university. It is to be noted, also, that the West Virginia University gives instruction by correspondence to those who desire to take a college course, but are prevented, by financial or other reasons, from attending college in person.

The twenty-eighth annual catalogue of the Worcester (Mass.) Polytechnic Institute, recently issued, shows 216 students, a large proportion of whom are taking the course in electrical engineering. The degree of bachelor of science is conferred on graduation. The degrees of mechanical, civil and electrical engineer are only conferred on graduates after from three to seven years of professional work of an acceptable character. In electrical engineering the course appears to be thorough and the laboratories are well equipped for work. Dr. T. C. Mendenhall is the president of the faculty and Harold B. Smith is the professor of electrical engineering. Entrance examinations are held at the institution on the 20th, 21st and 22d of this month and on Monday, September 12th, and succeeding days of that week. The Journal of the Worcester Polytechnic Institute is a bi-monthly magazine devoted to the interests of engineering and technical science. It contains articles of practical value from graduates. H. C. Smith is the editor.

ELECTRICAL SECURITIES.

The Chicago City Railway company has declared its regular quarterly dividend of three per cent.

The State Board of Railroad Commissioners of Massachusetts has approved an issue of $10,000 six per cent. 20-year bonds and $17,000 stock to the Conway Electric Street Railway company for funding debt incurred in an extension of the road to Deerfield. New six per cent. bonds have been almost unheard of in New England the last few years.

The Board of Railroad Commissioners of Massachusetts has granted an increased issue of stock to the Springfield Street Railway company to the amount of $291,700 for the purpose of capitalizing its floating debt and expense incurred by addition to its plant. The market value of its new stock is to be $150 a share. The company petitioned for an increase of $300,000.

The Edison Electric Illuminating company of Brooklyn reports gross earnings for April of $73,590, an increase of $5,605 as compared with the same month last year, and net $31,413, an increase of $544. For the four months ended April 30th the gross earnings were $310,369, an increase of $17,089 as compared with the corresponding period of last year, and net $143,084, an increase of $4,533.

A trust mortgage for $2,000,000 was filed in the register's office in Brooklyn, May 25th, by the Coney Island and Brooklyn Railroad company to the Mercantile Trust company on property at Smith and Huntington streets and Coney Island avenue and King's Highway, and upon the franchises of the company, to secure an issue of four per cent. bonds made necessary by the consolidation agreement with the Brooklyn City and Newtown Railroad company.

The Cicero and Harlem Street Railway company has filed a mortgage for $1,000,000 to secure an issue of bonds of like amount. The proceeds will be used to build the 2½ miles of the Chicago Lake street elevated extension, which property the mortgage covers. The mortgage is in the form of 1,000 bonds of the denomination of $1,000 of date of April 1st and maturing April 1, 1938, bearing five per cent. interest. Under the resolution passed by the stockholders authorizing the issue of the bonds, the company is also permitted to issue additional bonds to the extent of 75 per cent. of the cost of any permanent improvements or extensions that may be made.

Considerable activity was manifested in street-railway securities in New York last week. The heaviest trading was in Manhattan railway, which enjoyed a maximum advance of 2½ points. The movement was accompanied by rumors of an agreement between the company and the Rapid Transit Commission, and also of an alliance between the company and the Metropolitan Street Railway company. Neither report was confirmed, and the chances are that the advance was brought about chiefly by the temerity of professional operators in selling short a stock that is very closely held. Metropolitan Street Railway, after advancing

sharply, reacted as sharply and closed fractionally lower than when the movement began.

A mortgage for $15,000,000 was executed in Newark last week on behalf of the Manhattan Trust company of New York by the reorganized North Jersey Street Railway company, which has absorbed the Consolidated Traction company and now controls nearly all the trolley lines of Northern New Jersey. This mortgage covers all of the company's property in Essex County, and is given to secure $15,000,000 of gold bonds of $1,000 each for 50 years. The bonds are guaranteed for four per cent. per annum after May 1, 1899.

The gas and electric-light commissioners of Massachusetts have issued an order permitting the Dedham and Hyde Park Gas and Electric Light company to issue $60,000 first-mortgage bonds at five per cent. to run 20 years. Twelve thousand dollars is to cancel indebtedness, and $48,000 for enlargements. The commission, for the first time, uses its power to limit dividends, for the purpose of securing a reduction of capital. The company voted to reduce its stock from 2,000 shares, par value $50, to 1,600 shares, by exchanging shares for notes. This would not, of course, in any way decrease its indebtedness, and so the commission, by its order, provides that it shall not declare any dividends above three per cent. until a sufficient number of stock certificates have been canceled to carry into effect the vote to reduce the stock, or until otherwise ordered by the board.

MISCELLANEOUS.

At the Glasgow International Exhibition in 1901 special attention will be given to the section of electricity for lighting and power purposes. The guarantee fund for this exhibition already exceeds $1,750,000.

The San Diego (Cal.) Union of May 20th says that a large wave motor is being constructed at Oceanside by Schuyler Bros., which will furnish power to operate an electric-light plant, which is to be provided soon.

The relation between electric power and the house-fly nuisance does not seem apparent; but it is claimed, nevertheless, that the most hopeful token of the abatement of flies in cities is to be found in the substitution of electricity for horses on the street railways. Practically all flies are bred in stables, it is said, and therefore the fewer stables the fewer flies.

The Supreme Court of New York has just rendered a decision in the case of William Bracken against the Atlantic Trust company, for $151,124.82, in favor of Mr. Bracken. This was a suit to recover damages for the detention by the Atlantic Trust company of 30,000 shares of the capital stock of the Consolidated Electric Storage company of New York, to the delivery of which Mr. Bracken claimed to be entitled.

The Royal Academy of Sciences of Bologna, says Nature, announces that a gold medal, in memory of Aldini, will be awarded in 1899 for the best essay on animal electricity. The essays may be either in Italian, French or Latin. They may either be in manuscript or printed, but they must not have been published longer ago than two years before the award. Papers competing for the prize are to be sent before May 29, 1899, addressed to the secretary of the Royal Academy of Sciences of the Institute of Bologna.

The new tariff of Chile, which went into effect on the first day of January last, imposes a general duty of 25 per cent. ad valorem, and, in addition to that, there are several special classifications. Boats, if made of wood, for electric propulsion, pay 15 per cent. ad valorem; launches, iron or steel, electric, 15 per cent. ad valorem. Instruments, telephonic, telegraphic, insulators, iron or steel posts and all other special accessories for telegraphs and telephones, with the exception of the wooden cross-pieces for the posts, are admitted free of duty. Machinery, apparatus and special accessories for gas and electric lighting, with the exception of all kinds of lamps, not including arc and incandescent lamps for the electric light, are also admitted free of duty. Material of iron or steel for the permanent way of electric railways is free of duty.

TRADE NEWS.

William Roche of New York says that the independent telephone companies are taking very kindly to the "New Standard" dry batteries, and that the government is not behind. A large type of cell is being used on the cruisers for gunfiring, measuring 1.6 volts and giving a current of five amperes. It is said that it can give 17 amperes, but the life would be correspondingly lessened.

Stone & Webster, electrical experts and engineers of Boston, have recently published a small book in which is given some statistical matter regarding street-railway and electric-lighting properties in Massachusetts. There are 64 electric-lighting companies in the state, they say, and the "return on capital stock is 5.4 per cent. Outside of Boston this figure is diminished to 2.2 per cent."

Kaufman Bros. of Pittsburg, Pa., have placed an order with the Electric Arc Light company of New York for 400 Pioneer enclosed arcs, for use in their new building. A unique feature of this installation will be the complete lighting of the store with arcs and gas chandeliers. This is the first store in the country to be entirely equipped in this manner. Pioneer lamps were selected after a three months' competitive test.

The Fostoria Incandescent Lamp company of Fostoria, O., is a new concern which makes a specialty of the best work. Its recent exhibition at New York was very attractive and included what is claimed to have been the only successful 220-volt incandescent lamp at the exposition. The company turned out its first lamps in October, 1897, and its success has been mainly due to the efforts of its able superintendent, Mr. Hermann F. Schaedel, well known to the electrical fraternity, and to the skillful management and untiring push of the president of the company, Mr. J. B. Crouse.

The Westinghouse Electric and Manufacturing company has recently completed a novel electric plant for the Fletcher Manufacturing company of Providence, R. I. Until recently two engines were used by this company, one on each side of the street. Desiring to shut down one of them, it was found impossible to run a shaft under the street, but permission was secured to lay electric wires. The single engine will now operate the entire plant, by running a 150-kilowatt, 400-volt, two-phase Westinghouse generator, which transmits current across the street to a 200 horse power motor.

BUSINESS.

On receipt of postage, the Chicago Fuse Wire and Manufacturing company will send for ten days to anyone in the trade, a suitable box for holding legal papers or other valuables.

The Warren Electric and Specialty company of Warren, Ohio, announces that it is receiving a large number of suggestions of names for its new lamp, and as each suggestion must be accompanied with an order, it is correspondingly busy.

The direct-current desk and bracket fans of the Western Electric company are discussed in Bulletin 3-F. The motors are wound for 110, 220 and 500 volts, and may be run at three speeds. All the motors are designed for continuous running at any of the three speeds without sparking and without heating. A price-list is printed in the bulletin.

Chairs, tete-a-tetes and loungers in the observation car on the New Pennsylvania Limited are remarkable pieces of furniture in design, finish and convenience. They are something entirely new, and give the observation room the appearance of a grand parlor. For details about the train and route apply to H. R. Dering, assistant general passenger agent, 248 South Clark street, Chicago.

Bernard Hartley, manager of the Hartley Electrical Works, Chicago, reports an excellent business. The company is well known as one of the leading repair concerns of Chicago and has turned out many a noteworthy job in its line. Mr. Hartley is a man of wide experience in the business, having been connected for many years with the Westinghouse company. The company also deals in new and second-hand apparatus.

President W. N. Mathews of the St. Louis Electrical Supply company reports a fine demand for electric fans from all over the Southwest. The St. Louis Electrical Supply company is handling the Emerson alternating fan and the Western Electric direct-current type. It makes a point of carrying a large stock, not only of fans, but other electrical supplies, which should prove decidedly advantageous to buyers throughout the Southwest. President Mathews reports the outlook for business as being most encouraging; in fact, the establishment has often to work in the evenings to keep up with orders for construction material.

Bulletin No. 17 (replacing No. 6) of the Wagner Electric Manufacturing company of St. Louis is devoted to ventilating fans direct-driven by electric motors. A complete line of this apparatus has been placed on the market by the Wagner company. The motors are for direct current and wound for 110, 250 or 500 volts, and the fans are furnished for erection in three styles. Twelve speeds can be obtained by controlling rheostats. The great merit of these outfits, as compared with the desk fan and pedestal fan, is that they renew the air rather than simply stir it up. For public halls, restaurants and all other places where a great many people frequently assemble, in mines, cellars, etc., where foul air naturally accumulates, they are said to be a sanitary necessity.

In the line of suppying electric-power equipments for factory use the Westinghouse Electric and Manufacturing company has been particularly successful of late. It reports the following sales: Berlin Mill company, Berlin, N. H., two 180-kilowatt generators and a number of induction motors for driving planing and grist mills; M. G. Shaw Lumber company, Bath, Me.; Fries Manufacturing company, Salem, N. C., six induction motors to operate fertilizing machinery; Dennison Manufacturing company, South Framingham, Mass., three direct-current generators of 330 kilowatts total capacity and 17 slow-speed motors for driving shop machinery; Lyman Mills, Holyoke, Mass., one 225-kilowatt two-phase generator and six induction motors for the operation of spinning frames, mules, looms, etc.

The Electric Appliance company has recently closed a general western agency arrangement for the celebrated Armorduct interior conduit. The Armorduct is the latest product of the Armorite Interior Conduit company, manufacturer of the well-known Armorite steel-armored interior conduit. The Armorduct is a steel tube heavily enameled inside and outside by a special and exclusive process. The enamel placed on this tube gives a perfectly smooth interior, with a coating which will withstand a temperature of 500 degrees. Bending and twisting the tube will not crack or break the coat of enamel. Further than this, the enamel is absolutely proof against the action of cements or acids of any description. The Electric Appliance company considers that it has a very valuable specialty in Armorduct, and large sales are prophesied.

The Boiler Expurgator company of Chicago has issued a neat pamphlet extolling the merits of the boiler expurgator manufactured by it. This article is designed to remove the scale from steam boilers, and save money by holding the surface of the boiler in a natural condition, thus necessitating the use of less fuel than a boiler which has from one sixteenth to one-half inch of scale on its surface. The boiler can be run a longer time between washings, which reduces the expense of more frequent washing. The advantage of longer runs is that it avoids the serious injuries that result from frequent heating up and cooling off boilers. Repeated extremes of contraction and expansion are hard on boilers. The boiler expurgator prevents and removes scale, is said to be a sure preventive of foaming, and it is claimed that it is effective in all kinds of water. The boiler expurgator is the result of a long series of experiments made by a master mechanic, and consists of ingredients never before used for boiler-cleaning and foam-preventing purposes. It is in use in many of the prominent plants, and is said to give entire satisfaction.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued May 24, 1898

604,358. Valve-controlling Device. Walter S. Alexander, New York, N. Y. Application filed February 24, 1896.

A valve-controlling device is described. One feature is the operation of two auxiliary valves by an electromagnet suitably mounted on the main-valve stem.

604,373. Automatic Telephone Exchange. Ward Decker, Owego, N. Y. Application filed March 25, 1895.

The principal features are a short-circuited telephone receiver, a circuit-breaker for breaking the short-circuit, an electromagnet for operating the circuit breaker, all in combination with a calling-generator connected with the electromagnet, whereby the short, circuit is broken on operating the calling-generator.

604,384. Electric Heater. Edward E. Gold, New York, N. Y. Application filed October 14, 1897.

An electric heater comprising an insulating open-work support consisting of a thin foraminous tube and a helix of resistant wire wound helically around the support, whereby air may circulate between the meshes of the helix and through the openings into and out of the interior of the support and into contact with all portions of the heated resistance wire.

604,418. Accumulator Plate. Isidor Rosler, Berlin, Germany. Application filed March 10, 1898.

The plate consists of a continuous zigzag core piece, the surfaces of which on both sides are fitted with triangular webs wholly separated from each other.

604,431. Electric Signal for Railway Crossings. Leon C. Smith, Columbus, Ohio. Application filed May 18, 1897.

An arrangement of electromagnet and stop projections at a railway crossing to ring a bell automatically on the approach of trains.

604,434. Telephone Signal System. Wallace A. Stilwell and Alexander Barneck, Salina, Kan. Application filed November 10, 1896.

The second claim describes a telephone switchboard comprising two series of fixed contacts arranged in concentric circles, a common conductor normally connected with each contact of one of the series, a series of wires arranged in pairs, the ends of the wires of each pair terminating in a contact in each series, a switch arm movably secured relatively to the series of contacts and normally electrically connected with the common conductor and permanently connected through a telephone station with the ground; this switch is adapted to simultaneously connect with the contiguous ends of any pair of wires in the series.

604,453. Secondary Electric Clock. Aaron D. Blodgett, Newton, Mass. Application filed May 20, 1897.

The mechanism of an electrically controlled clock is described.

604,459. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed March 20, 1897.

The meter is provided with a rotating armature, field-coils connected in series in an electric circuit, volt-coils co-operating with the field-coils to set up a shifting magnetic field to actuate the armature, a transformer having a primary coil in shunt across the circuit, a closed-circuit secondary coil between which and the primary coil a consequent magnetic field is set up and a tertiary coil wound to inclose the lines of the magnetic field and connected in series with the volt-coil.

604,460. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed August 6, 1897.

This instrument has an annular armature and a plurality of magnetic fields, part of which are set up within and part without the armature, two fields being arranged on the same side of the annular wall of the armature on separate axes located on opposite sides of the axis of a field on the other side of the annular wall from the two fields, and means for producing a phase displacement between the inner and outer fields.

604,461. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed August 6, 1897.

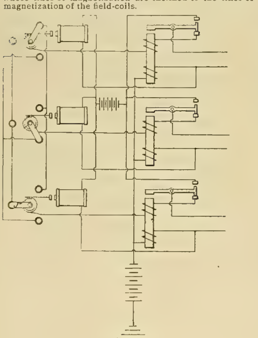
Especially designed for multiphase currents, this meter is equipped with a rotary armature, a pair of series coils, one connected in one circuit from the generator and the other connected in another circuit from the generator, and two sets of shunt-coils, the set adjacent to each series coil being connected in the other circuit from that in which its adjacent series coil is connected.

604,462. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed August 11, 1897.

The combination of an annular rotary armature, a magnetic field exterior to the armature, a plurality of magnetic fields within the armature and having intersecting axes, each of which is arranged at an angle to the axis of the exterior field, and a friction compensating magnetic axis arranged at right angles to the axis of the exterior field, is described.

604,463. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed August 26, 1897.

In a motor-meter, a revoluble metallic armature and a series of field-coils without the armature whose adjacent poles are in close proximity thereto, and in such relation that the resulting intersecting lines of magnetization are at right angles to each other; this is in combination with an equal number of volt-coils located within the armature whose lines of magnetization are inclined to the lines of magnetization of the field-coils.



NO. 604,373.

604,464. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed September 11, 1897.

This meter is for alternating-current circuits. The method of measurement consists in setting up or establishing a shifting field of magnetism from three intersecting lines or axes of magnetization, and is adapted to actuate a rotatable armature in a motor-meter arranged within the energizing coils producing the lines of magnetization.

604,465. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed September 24, 1897.

In a meter for measuring large electric currents a stationary field conductor having a detachable section, a disk-like armature comprising a series of sector-like coils, and arranged in inductive relation to the conductor and a commutator provided with proper contact-brushes.

604,466. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed November 8, 1897.

This is a motor meter and comprises a series field representing the main current, a revoluble armature in inductive relation to the field, a volt-coil or coils arranged in inductive relation to the armature, a secondary coil closed through a suitable resistance and acting inductively in co-operation with the volt-coil or coils upon the armature, and a compensating device comprising an iron core and a closed circuit or secondary, the compensator being adapted for adjustment relative to the armature.

604,471. Electric Brush. [illegible] M. Hellwig, Chicago, Ill. Application filed December 11, 1896.

In the back of the brush is a cavity, containing a small battery and two metal sockets out of contact with the bristles, but connected with the battery poles. An insulated conductor connects the bristles with one of the sockets. The brush handle has an insulated contact plate, which is connected by a wire with the other socket in the cavity. Manipulation of the contact plate controls the current.

604,499. Multiple Telephony and Telegraphy. Richard Pfund, New York, N. Y. Application filed October 22, 1897.

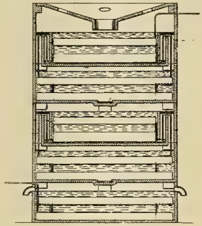
A through metallic circuit having telephone stations included therein or connected therewith, signaling magnets for the stations bridged across the two wires of the circuit, an extra circuit uniting the middle points of the signal-magnets whereby an independent circuit is obtained between the stations, and instruments for communication, located in the extra circuit.

604,501. Motor Wattmeter. Carl D. Raab, Kaiserslautern, Germany. Application filed December 27, 1897. Patented in Belgium June 30, 1897, and in Spain July 10, 1897.

This is a motor-meter for measuring watts. The essential features are two horseshoe electromagnets, a disk armature and a main-current solenoid at the other side of the disk from the magnets.

604,508. Electric Clock. William Whitehead, Manchester, England. Application filed June 7, 1897.

An electric clock mechanism is described.



NO. 604,588.

604,511. Driving Mechanism for Dynamos. Philemon W. Alexander, Allapaha, Ga. Application filed September 21, 1897.

Mechanical means of conveying the power from the axle of a car truck to a dynamo pulley are described.

604,533. Combined Transmitter and Receiver. John M. Joy, New York, N. Y. Application filed June 21, 1897.

An improved printing-telegraph apparatus is covered by this patent.

604,544. Electrical Governor. Mark A. Replogle, Akron, Ohio. Application filed February 19, 1897.

In combination with an electrical governor having a pair of electromagnets, a pair of insulated electrical contact-points by means of which electrical circuits may be completed through the magnets, the insulating contact-points being separately adjustable and jointly movable.

604,588. Storage Battery. Herbert S. Lloyd, Philadelphia, Pa. Application filed December 23, 1896.

A series battery comprising a number of superposed cells, overflow-partitions in each cell communicating with an opening in the bottom of the cell, and arranged to form passages for the overflow of the excess of electrolyte into the cell below, electrode-supports in the cells, and connecting wires or strips extending between adjacent cells.

NO. 604,626

604,616. Automatic Resetting Fusible Cut-out. John D. Holmes and Webster L. Heath, St. Louis, Mo. Application filed April 12, 1897.

In a fusible cut-out, a movable member, fuse-holding devices carried by the movable member and normally locking it, the fuse-holding devices being arranged in pairs and insulated from each other, means for releasing the movable member when a fuse is burned out, and line-wire terminals adapted to be put in electrical communication with one pair only of the fuse-holding devices at a time.

604,626. Electrical Lighting Device for Kerosene or other Burners. Svend M. Meyer, Brooklyn, N. Y. Application filed January 27, 1897.

A device for lighting oil lamps by electricity comprising a suitable lamp-body, a burner separable therefrom, a source of electricity in the body or base of the lamp grounded by one pole in the lamp-body, an insulated conductor from the other pole, an igniting device mounted on the removable burner grounded by one end in the metal of the burner and connected at the other end with an insulated conductor, insulated contact devices carried by the lamp-body and removable burner respectively and respectively connected to the insulated conductors therein, so as to form electric connection between the insulated conductors when the burner is placed in position, and a suitable device for closing the electric circuit by hand.

604,679. Incandescent Electric Lamp Regulator. Daniel McF. Moore, New York, N. Y. Application filed February 10, 1892.

The third claim is for an automatic circuit-breaker in the circuit of the lamp filament, with provision to make and break, rapidly and continually, the circuit through the lamp filament.

604,680. Electric Lamp Regulator. Daniel McF. Moore, New York, N. Y. Application filed October 13, 1894.

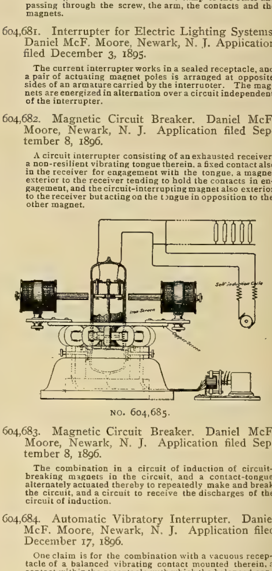
The combination with the base of an incandescent electric-lamp socket of an electromagnet, a bulb having a vacuum or inert atmosphere, a vibratory armature within the vacuum within inductive relation to the magnet, a flexible arm carrying the bulb and movable to and from the magnet, an insulating-stop for limiting the movement of the bulb from the magnet, a screw provided with a handle passing through the socket-frame and movable to and from and against the arm, and electric contacts within the bulb and controlled by the armature, the electric circuit being from one terminal of the lamp to the other and passing through the screw, the arm, the contacts and the magnets.

604,681. Interrupter for Electric Lighting Systems. Daniel McF. Moore, Newark, N. J. Application filed December 3, 1895.

The current interrupter works in a sealed receptacle, and a pair of actuating magnet poles is arranged at opposite sides of an armature carried by the interrupter. The magnets are energized in alternation over a circuit independent of the interrupter.

604,682. Magnetic Circuit Breaker. Daniel McF. Moore, Newark, N. J. Application filed September 8, 1896.

A circuit interrupter consisting of an exhausted receiver, a non-resilient vibrating tongue therein, a fixed contact also in the receiver for engagement with the tongue, a magnet exterior to the receiver tending to hold the contacts in engagement, and the circuit-interrupting magnet also exterior to the receiver but acting on the tongue in opposition to the other magnet.



NO. 604,685.

604,683. Magnetic Circuit Breaker. Daniel McF. Moore, Newark, N. J. Application filed September 8, 1896.

The combination in a circuit of induction of circuit-breaking magnets in the circuit, and a contact-tongue alternately actuated thereby to repeatedly make and break the circuit, and a circuit to receive the discharges of the circuit of induction.

604,684. Automatic Vibratory Interrupter. Daniel McF. Moore, Newark, N. J. Application filed December 17, 1896.

One claim is for the combination with a vacuous receptacle of a balanced vibrating contact mounted therein, a contact within the receptacle with which the balanced contact co-operates to make and break circuit, magnets for vibrating the balanced contact, and a striker for jarring the receptacle occasionally to insure the continued operation of the balanced contact.

604,685. Electric Lighting Apparatus. Daniel McF. Moore, Newark, N. J. Application filed February 15, 1897.

In a rotary current interrupter contained within a sealed receptacle, the combination with the armature in the receptacle of means for producing a rotating field to rotate the armature, the means comprising a fixed system of windings similar to the armature system of a dynamo-electric machine or motor, a rotating commutating device for the system and a circuit of self-induction exterior to the sealed receptacle and connected through the walls thereof to the contacts of the interrupter.

604,686. Apparatus for Producing Luminous or Similar Effects. Daniel McF. Moore, Newark, N. J. Application filed July 3, 1897.

Luminous effects are produced by interrupting a circuit of induction to which vacuous receptacles and interrupter contacts are attached.

604,687. Circuit-interrupting Mechanism. Daniel McF. Moore, Newark, N. J. Application filed September 9, 1897.

The combination with a vacuous receptacle of a circuit interrupter therein, a motor for driving the interrupter, the rotary part of which motor is within the receptacle and has its coils insulated and thoroughly imbedded in a vitreous mass.

604,688. Circuit Interrupter. Daniel McF. Moore, Newark, N. J. Application filed September 10, 1897.

A circuit-interrupter consisting of a metallic foundation provided with openings or depressions and successive layers of a vitreous insulating substance deposited therein and having a fused connection with the metal, the surface of the metal and insulation made level and smooth.

Western Electrician.

EVERY SATURDAY.

Vol. XXII. CHICAGO, JUNE 11, 1898. No. 24

Alden M. Young, President National Electric Light Association.

The newly elected president of the National Electric Light association, Mr. Alden M. Young of Waterbury, Conn., has for many years been closely identified with central-station work throughout New England, and of late he has extended his operations to New York. He may be said to have been engaged in electrical pursuits all his life and is acquainted with every class of service, including telegraphy, telephony, lighting, power transmission and street-railway work. At present he is particularly interested in commercial lighting and is establishing a large central station in the borough of Brooklyn, although he still retains his interests in the New England enterprises which he had established before venturing into the metropolitan project.

Mr. Young is a forceful character, as will be readily appreciated by glancing at the accompanying portrait. Possessed of great energy and natural ability, he has developed a capacity for organization and executive management that has already commanded recognition on the part of capitalists and managers of electrical properties. These characteristics will be appreciated more fully after an acquaintance with what he has already accomplished.

Mr. Young was born at Hadley, N. Y., in 1853, and passed his boyhood days in that neighborhood. His first practical experience was gained in the telegraph business, which he entered immediately upon leaving school. He secured a position with the old Atlantic and Pacific Telegraph company and was stationed successively at Saratoga, Albany, Syracuse, Buffalo, and finally at New York. In 1878 he became interested in telephony and organized an exchange at Waterbury, Conn., which ultimately became a valuable property. He extended his operations and entered the electric-lighting and street-railway field, organizing several companies and contributing largely to the successful introduction of these systems in several New England towns.

Mr. Young has done much to raise the standard of engineering and construction work throughout the territory in which he has operated. He formed the New England Engineering company of Waterbury and is now president of that concern. It is engaged in general engineering and construction work, including steam plants and gas works, as well as electrical engineering.

Mr. Young is actively engaged in the management of several operating companies, and it is said that he is an officer in at least a dozen more in Connecticut, Massachusetts and New York. Among those with which he is prominently identified are the Central Railway and Electric company of New Britain, of which he is president, the Waterbury Traction company and the Norwich Gas and Electric company, in both of which concerns he occupies the position of secretary. Some idea of the magnitude of the interests involved in these enterprises may be gained from the fact that the three concerns just mentioned represent an investment of $1,600,000 in capital stock and $1,483,000 in bonds. The New Britain concern furnishes current for 260 arc lamps, 13,000 incandescent lights and 1,600 horse power in motors. The electrical equipment of the Norwich concern comprises an arc and alternating incandescent system supplying current to 217 arc lamps and 3,000 incandescent lights. The motor service aggregates 380 horse power. The Waterbury plant has a "mixed system" of 400 arcs, 8,000 direct-current incandescent and 5,000 alternating-current incandescent lights. The plant also furnishes current to motors of 1,950 horse power capacity.

It will be understood from this brief outline of President Young's career that he has had considerable experience in central station electric-lighting business and is thoroughly equipped for the office to which he has just been elected. But it should be mentioned that the most important work of his career is that in which he is now engaged in the establishment of the Kings County Electric Light and Power company. Mr. Young is general manager of the new concern, and he is now personally superintending the building of the company's station in Brooklyn.

ALDEN M. YOUNG, PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION.

Northwestern Electrical Association.

The plans for the Northwestern Electrical association convention were perfected in all their details during the week, many members of that organization assembling in Chicago while the National Electric Light association was in session. President Copeland was an early arrival, and he aided materially in securing members for the trip.

The steamer Northwest, which was tied up at Kirk's dock on Thursday was visited by a large number of Chicagoans.

The party started for Milwaukee Friday afternoon. Several representatives of Duluth, Houghton and the Soo, who came to Chicago early in the week, accompanied the association as an escort. One of the inducements offered was an invitation to witness the newest wonder in American engineering, the Red Jacket shaft of the Calumet and Hecla—the greatest mining shaft in the entire world. It is 4,900 feet deep, and, compared with it, the deep silver mines of the Comstock lode in Nevada, or the wonderful mines of Austria, are said to be but shallow pits. There are six compartments, each equal in size to an ordinary mining shaft, four of these being used for hoisting rock and lowering timber, one is used for the ladderways, while the sixth compartment carries the wires and pipes for telephones, light, power, water and compressed air. The underground workings of the shaft are laid out with mathematical accuracy, the undeviating course of the copper-bearing lode allowing work to be planned thousands of feet ahead of the mineral picks. The great pumps which free the mine of water are operated interchangeably by compressed air and electricity. The party expects to spend a day at these mines.

As already announced, the programme provides for an informal discussion of several topics, including "Electrical Measuring Instruments," "Lightning Arresters," "Transformers," "Meters," "Arc and Incandescent Lamps," "Motors," "Engines," "Furnaces" and "Mechanical Draft." A paper on "Electrical Smelting of Ores," by W. S. Horry, is the principal feature.

Control of Alley "L," Chicago.

Announcement is made that several directors of the South Side Elevated Railroad company and certain directors of the Chicago City Railway company have reached an agreement, which, if carried through, will again place the elevated property in the control of interests identified with the South Side surface system.

On Monday it was reported that the City Railway had already secured control of the "L" road by private sale, but this is denied. The story is that the parties in interest contemplate a campaign against South Side "L," which will force its price down to a reasonable buying point from the City Railway point of view. It has been observed that certain large South Side "L" interests which were enthusiastic on the property are now only lukewarm in their praise of it as an investment. Only recently dividends were predicted at an early period, but now the management professes not to see any distribution on the stock in sight. It is stated that certain South Side "L" directors who have not been let into the alleged deal have gotten wind of the fact that it is on and are preparing to do all in their power to block it.

While it is true that only recently the City Railway let control of the South Side 'L" get away from it, it is also true that many large stockholders of the surface-line company condemned as very unwise the policy which permitted this, and it would seem that the position of the latter was indorsed by the present management of the City Railway, when only a few months ago it exploited a project for an elevated strcture in Dearborn street. The plans, with considerable detail, were given to the public, but since the first announcements were made no action toward carrying out the scheme has been taken. Those who believe the reports about a deal between the City Railway and the Alley road insist that the Dearborn street "L" stories were given out without sincerity as a bear point on South Side "L," and regard the announcement simply as a feature of the alleged deal now working.

If the City Railway does again get control of the Alley Elevated, it will probably use it as a trunk line, to which all the long-haul traffic from its electric lines will be transferred. The company's need of an entrance to the congested heart of the city over an elevated way was strongly presented by President Bowen when he explained the Dearborn street "L" plans not long ago.

The City Railway owns a good-sized interest in the South Side Elevated already, and the fact that it is preparing to increase its holdings, until it controls the elevated competitor, is believed by many to be the cause of the 40-point advance in its stock lately recorded. Friends of the company who predicted a price of 300 for the City Railway last week now talk of 350 for it.

Although it is not possible to confirm this story, it finds many firm believers among investors in this class of securities.

Other sources of information convey the impression that the alleged deal is far from being an assured fact. Some go so far as to say that the rumors have no basis in fact, that the elevated road is not for sale and that the management is concerned only with the development of the property. So far as this process has extended along the line of loop extension and electrical equipment, the results have been encouraging, both in increase of traffic and economy of operation. There remains the problem of extending the line to Englewood, a branch of which the road stands in need, and which it is expected would contribute at least 10,000 passengers a day. It is admitted that certain interests in the City Railway and the South Side favor a consolidation, but it is equally possible that other interests are strongly opposed to the only terms which have been mentioned. Some of the strongest elevated interests consider par a fair price for their stock, figured on its prospects, while the City Railway is hardly willing to pay that price. Meanwhile it may be said that the predictions of the management as to the future of the property are having steady fulfillment.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The Chicago meeting of the National Electric Light association was a successful gathering in every respect. The attendance was large and representative, the meetings were well attended, the programme proved attractive and the papers presented provoked much discussion. More attention was paid to the proceedings than ever before in the history of the organization, and in this respect at least the Chicago convention will mark a departure from the experience of the association in former years.

Every paper and every topic of discussion on the programme proved an attractive feature, and the fact that every session was prolonged beyond the time originally set, owing to the interest manifested in the discussions, proves conclusively that the subjects chosen for consideration were wisely selected and the method of handling them suited for the purpose. Every detail had been carefully planned and was executed with precision.

Tuesday's Proceedings.

The meeting room was taxed to its utmost capacity when President Insull called the twenty-first convention of the National Electric Light association to order at 11 o'clock Tuesday morning in the Auditorium Hotel, Chicago, and formally opened the proceedings by reading his annual address, which is herewith appended:

President Insull's Address

In calling to order the annual convention of your association my dual capacity presents somewhat of an embarrassment to me. I am in doubt whether as president to enlarge upon the great growth of this association since its formation in this city on February 25, 1885, or whether as a resident here to dwell at length upon the marvelous growth of the city in which we meet. Chicago and the industry with which we are identified have a somewhat close connection. The growth of the former, if measured from the point of view of the rapidity with which history is made, is, so to speak, the product of yesterday. The electrical industry, or rather that portion of it with which we are associated, is but little more than the product of to-day. If the growth of this city and that of our own industry is as great during the next 13 years as the progress that they have achieved since the date of your first meeting here, I am sure that both the citizens of Chicago and the members of your association will have every reason to congratulate themselves. Speaking for those of my friends connected with the electrical industry in Chicago, and also for myself, I can assure you that it affords us very great pleasure to welcome you at this convention, and the fact of your meeting in this, my home city, enhances not a little my high appreciation of the privilege of presiding on this occasion.

The officers of your association have had in mind in preparing a programme for this convention the importance of bringing before you subjects of interest in connection with central-station management, and the papers to be read at our various sessions and the topics mentioned for discussion cover such a wide range that it would seem undesirable for me to occupy much of your time by way of introduction. The various gentlemen who have so kindly consented to read papers will deal with such important questions as the cost of generating and distributing the product which we manufacture, transformer economy, and the rival claims of alternating currents and direct currents as means of distribution. The many problems which you have to solve in connection with the question of public lighting and the cost of producing electrical energy by water power, will also be discussed.

Standard vs. Special Machinery.

A matter which has called forth during the last year considerable discussion is the question of the use of standard apparatus and the tendency towards the specification of special machinery on the part of electrical engineers. This course is not by any means confined to large work, but is followed by some engineers whether they are designing a small isolated plant or are projecting a large modern central station. It would seem to me to be of paramount importance to the manufacturer and user that both should co-operate in eliminating as far as possible from the business the necessity of building and using special types of machinery. This can only be done by the adoption of standard specifications for various standard types of apparatus. A committee of the American Institute of Electrical Engineers has already taken this subject under consideration, and I believe that we will be serving alike the interests of the manufacturers and users of electrical apparatus if we will take some action with a view to co-operating with the Institute and other bodies in this matter. In drawing attention to this subject I speak with an appreciation of the position of both manufacturer and user, having had more or less connection with the manufacture of electric apparatus and the manufacture of electric current. Constant duplication of parts resulting in constant duplication of a given piece of machinery means, as any manufacturer will tell you, constant reduction in cost. Variation from a given type means increased cost and even the wiping out of an apparent profit. In the last year or so there has been a great deal of discussion in England prompted by the success of American manufacturers in obtaining large contracts for electric-traction work in Great Britain, and the inquiry has often been made, how is it possible for American electrical manufacturers, with high wages against them, to compete with English builders, whose scale of pay to their workmen is on a very much lower basis. If you will examine into the amount of electric-traction machinery manufactured in this country under a system of constant duplication and the use of special tools, and then visit the electrical establishments on the other side of the water and note the tendency there towards specializing each particular job, you will soon recognize that the reason for low cost and consequently low selling price on this side of the ocean, is brought about by the fact that in America this class of work

MEMBERS AND VISITORS AT THE CHICAGO CONVENTION.

The social features of the meeting proved highly agreeable to those who participated. They are considered more in detail elsewhere in this issue.

The opening meeting was attended by four ex-presidents of the association, Judge Armstrong of Camden, N. J., Mr. Ayer of Boston, Professor Weeks of Kansas City and Mr. Wilmerding of Chicago. There were also two visitors from Japan, who were greatly interested in the proceedings, and several Canadian engineers and one Mexican visitor were included in the gathering.

It is worthy of remark that from the opening of the first session to the conclusion of the last business on Thursday, the proceedings were conducted expeditiously and interest was maintained throughout. Mr. Insull proved a very efficient presiding officer, and much credit is due him for the success which attended the convention.

The meetings were held in the large banqueting hall on the sixth floor of the Auditorium Hotel, and the quarters proved very well adapted to the needs of the association. A detailed report of the proceedings is herewith presented.

is largely designed by the manufacturer, and, as a natural result, is the duplicate of something already produced, while on the other side of the Atlantic the builder of the machinery works from the plans of the electrical engineer, which necessitates his producing something different to fill each different contract. In one case the machinery is really manufactured; in the other case the builder runs a jobbing shop. Unfortunately, during the last few years American users of electrical apparatus have somewhat departed from the pursuance of what is really a fundamental principle of American manufacture, namely, the use of existing types which are turned out in large quantities with special tools, with a view to the lowest possible cost of production. The electrical engineer for the purchaser has been permitted to draw up specifications which have tended towards the specializing of apparatus, necessarily interfering with rapid manufacture and low cost of the product. The disadvantage to the manufacturer is apparent. It is turning our large electrical works from manufacturing establishments into jobbing shops, cutting down their capacity, increasing their labor cost and lengthening the time that it takes to produce a given article. Looking at it, therefore, from the point of view of the manufacturer, the capacity of his plant is reduced, and consequently his interest and general expense cost is higher; his labor cost is increased; and if he finds himself unable to increase his selling price, his shop must be run at a loss instead of at a profit.

The user is necessarily interested in low cost of production on the part of the manufacturer, as he cannot expect to purchase apparatus except at prices which yield a return to the maker. From this point of view alone it would seem to me to the interest of the user that he should co-operate with the manufacturer with a view to standardizing apparatus, eliminating unnecessary variations from a given type and providing specifications for machinery calling for a given capacity at a given efficiency. Such a course would lead to low cost of manufacture and consequently low selling price, coupled with rapid production.

Another objection to special apparatus is the expense and delay in obtaining duplicate parts in case of breakdown. The fear of delay under such circumstances often necessitates the user carrying the duplication of his plant to a point entirely unnecessary when standard apparatus is used. Capital investment and consequently interest cost is thus increased, not only by the purchase of apparatus which of itself is expensive to build, but also by the duplication of investment, which I have pointed out must of necessity follow.

A further point which should be borne in mind in connection with the lack of standard specifications is the opportunity that it gives to the unprincipled manufacturer to dispose of his second-rate apparatus to the uninitiated. We talk of a machine having a given capacity, but under what conditions should it operate to develop this capacity, and how often does it occur that a dynamo machine is rated entirely too high and at the cost of its efficiency? How much miscellaneous material used in connection with the industry is absolutely unfitted for the purpose for which it is sold? Surely all of us, manufacturers and users are interested in maintaining the highest possible standard of work and eliminating alike from our central-station systems and the installations for our customers worthless appliances whose only recommendation is their apparent cheapness; whereas, as a matter of fact, they are really the most expensive that can be bought, because they are unfitted for the purposes for which they are intended. A proper consideration of this subject would not embrace alone the apparatus we are ourselves in the habit of buying for use in connection

CALVIN W. RICE.

with our plants, but also the appliances used in connection with customers' house wiring. It should be borne in mind that faulty apparatus, from one cause or another, resulting in a stoppage of the service of one or more customers is, in the mind of the user of current, set down to the unreliability of the system as a whole. A central-station customer seldom discriminates between a contractor who supplies a worthless device and a company supplying him with current. Standard specifications should therefore cover not alone the machinery used, but also the devices and material forming part of a customer's installation. This association has addressed itself at various times to the consideration of questions in connection with house wiring, and has co-operated with the National Board of Fire Underwriters and other bodies with a view to establishing rules to be followed by contractors. I strongly recommend that this matter be taken up on a broader basis than heretofore, and that in connection with the technical societies we invite the co-operation of the electrical manufacturers with a view to standardizing apparatus and the specification therefor, whether for use in the central station itself or in connection with the distributing system.

I do not want my remarks on this subject to be taken as in any way censuring the many electrical engineers who have by their special training and natural ability done so much to develop the industry with which we are connected. From my experience I am satisfied, however, that from the point of view of the user, the designing engineer who adapts his requirements to the standard apparatus of a first-class manufacturer, is able to produce a plant of more satisfactory character and more economical to operate than that designed by those engineers whom, I regret to say, are sometimes influenced by the desire to use machinery which they can claim as their own handiwork, rather than use something that would be quite as satisfactory and has the advantage of being the regular product of an established manufacturer.

The consideration of the subject of standard specifications would naturally include the preparation of specifications with relation to the manufacture of incandescent lamps. For several years past a committee of this association has had this subject under consideration. It has been found practicable by a number of large central-station companies connected with another association and buying from one manufacturer to purchase their lamps under specifications which provide for the testing of samples of the product of the factory, the payment for lamps supplied being based on the results of the tests. It seems to me that it would be possible to adopt standard specifications under which our members could purchase their lamps from any reputable lamp manufacturer. The importance of this matter will be appreciated when it is remembered that the cost of lamp renewals per unit of output exceeds $1 per ton of the cost of fuel in operating a central station, with the most modern steam plant.

Selling Price Based on Cost.

It is of prime importance to central-station managers that they should sell the product they manufacture, namely, electric current, to the greatest number of consumers at the lowest possible price, and yet obtain a reasonable profit. For a number of years the basis of charge on the part of most companies has been a given unit price, with discounts for quantity. In the early days of the business some companies were in the habit of charging a fixed price per lamp per month, having no control whatever over the use of the product, but being necessarily responsible for the increased operating expenses caused by the wastefulness of customers, who could hardly be expected to economize, inasmuch as they paid exactly the same price for the use of light, whether they burned it one or 24 hours a day. A majority of these companies, however, following this last method realized at an early date the absurdity of distributing that for which they were not paid, and, as a result, I presume we can fairly assume that electric lighting business (with the exception of arc light service) is run almost universally on a meter basis. It is therefore unnecessary for us to discuss the question as to whether the measuring of current is a desirable thing in our business, as it is now generally recognized as a necessity. If you will make a careful examination of the factors [illegible]

COACHING PARTY STARTING FROM AUDITORIUM.

tering into the cost of current you will very quickly come to a realization of the fact that interest is by far the most important single element, and that this item varies very considerably with the different classes of service furnished by a central-station company. The interest factor in cost depends upon the yearly average consumption of your product by the customer; or, to put it another way, you can figure your interest on the basis of so much per unit of output at maximum load. For instance, take the two probably extreme classes of customers to whom the central-station company supplies current for lighting purposes. On the one hand, you have an office building whose tenants only use artificial illumination for a very short space of time each day during the winter only. On the other hand, you have a basement customer whose use of your prod-

WAGNER COMPANY'S HEADQUARTERS AT CHICAGO CONVENTION.

uct averages nearly one-half of the day of 24 hours during the whole year. Your investment, to take care of each of these customers is practically the same; therefore, your total interest cost must be the same in both cases, but if you distribute this interest cost over the actual units consumed you will find that the tenant of the office building costs you for interest per unit of current sold many times more than does the occupant of the basement. There are, of necessity, as many different grades of customers between the two extremes I have mentioned as there are different classes of business and different characters of structures in which these businesses are conducted. Surely, if the cost of production varies according to the different conditions under which your customers use your product, it is but fair that the selling price per unit should vary correspondingly. If it does not, you, of necessity, encourage the use of electricity by customers whose business is unprofitable to you, and discourage the use of your product by customers whose business at a lower price would yield you a fair return. In past conventions the questions of how to improve the day load for the purpose of raising the average output, what classes of business should be encouraged other than lighting to achieve this result, and the price at which we can afford to sell current to the operators of these different lines of business, have come up for discussion. At the last convention the realization of the fact that great differences exist in the elements governing the cost of product for different classes of lighting customers, was ably presented by Mr. Arthur Wright, and he pointed out that the improvement of your load factor, the broadening of your curve and the rendering less acute of your peak is a matter within your own adjustment, providing that you will realize in considering cost with a view to making a selling price, that conditions are so dissimilar that the expense to you per unit of supplying two customers in the same block is likely to be widely different. Various plans have been adopted by a comparatively small number of companies to meet the conditions as we now know them to exist. Some companies have adopted the scheme of allowing certain special discounts, providing the income per month per lamp connected exceeds a certain amount. Other companies charge one rate for current used during certain specified hours of the day and a much lower rate for the current used during the remaining hours of the day. A third method is a system of discounts based upon the total consumption of current during a given period, considered in connection with the maximum consumption at any time during that same period.

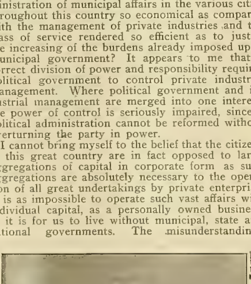
These various methods all have the same object in view, namely, the meeting of the conditions of each individual customer, and yet at the same time earning a fair return on all of the investment provided for all of your customers.

In discussing this matter I have referred alone to interest cost because it forms so large a proportion of the total cost, but you will find that this same principle enters into a number of the other elements which go to make up your total cost. It would therefore appear to me that in considering the cost of generating electricity you should bear in mind that a large proportion of the [illegible] which go to make up the total are within [illegible] control and their amount per unit of output depends very largely upon the methods adopted in selling your product.

Public Control and Private Operation.

A subject of growing importance to a number of our members is the question of the public ownership and operation of the undertakings now operated by electric lighting companies. The agitation in connection with this subject has called forth a great deal of discussion, partly by those interested in it simply with a view to extending the influence of political parties, and partly by serious disinterested thinkers who believe that the best interests of the greatest number are to be obtained by the creation of a municipal socialism, which, if carried to its logical conclusion, must ultimately result in municipalities performing, with others, such public-service work as we are engaged in, and also in producing the food we eat and the clothes we wear. To those occupied in the management of electric-lighting properties it does not seem possible that the movement in favor of municipal operation of electric-lighting plants, based upon the assumption that a municipality can produce electricity cheaper than, or even as cheap as, a private corporation is well founded. We all realize from the close attention we have to give to our own affairs, that self-interest and the necessity of getting a return on our investment are the first essentials to the economical administration of large enterprises. While I do not pretend to claim that electric-lighting companies are beyond reproach, I wish to point out that many of the evils complained of as pertaining to corporate management are the direct results of the enforcement of unwise conditions through legislative action. Ill-advised efforts are often made by legislative bodies to secure advantages in the direction of control which cannot be obtained without giving an equivalent in protection to the industry. This causes the investor to feel that his property is being attacked and compels him to resist such legislation. The result is a feverish agitation, crimination and recrimination, between the would-be improvers of municipal government and the owners of corporate properties without reaching a conclusion satisfactory to either. The fallacy of the so-called reformer's theory results from looking only at what he calls the injurious effects of corporate management without taking into account its indisputable benefits. He does not seek for the cause of the trouble. If reformers will take accurate account of all the points in the problem they will discover that the evils complained of result from errors in legislation designed to determine the relations between municipal bodies and electric-lighting companies. It seems to me that the claim that municipal operation is the universal cure for all diseases for which electric-lighting companies are supposed to be responsible, merely proposes the substitution of political in the place of industrial management. This raises the question: Is the administration of municipal affairs in the various cities throughout this country so economical as compared with the management of private industries and the class of service rendered so efficient as to justify the increasing of the burdens already imposed upon municipal government? It appears to me that a correct division of power and responsibility requires political government to control private industrial management. Where political government and industrial management are merged into one interest, the power of control is seriously impaired, since a political administration cannot be reformed without overturning the party in power.

I cannot bring myself to the belief that the citizens of this great country are in fact opposed to large aggregations of capital in corporate form as such aggregations are absolutely necessary to the operation of all great undertakings by private enterprise. It is as impossible to operate such vast affairs with individual capital, as a personally owned business, as it is for us to live without municipal, state and national governments. The misunderstandings

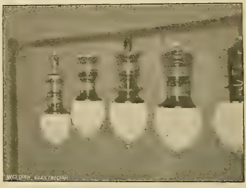


KASTER CARBON RHEOSTATS AT CHICAGO CONVENTION.

which, from time to time, occur between communities and the managers of electric-lighting companies will, to my mind, disappear entirely if the relations between the two are correctly founded on the basis of public control, with corresponding protection to the corporations operating this industry. It would seem to me to be a very proper function for this association to address itself to educating the public to a definite legislative policy which will be fair to the municipalities, securing to the public the best service at the lowest possible price, and protect corporations by giving them franchises, which, while conserving municipal control, will insure to the investor the permanency of the undertaking.

Competition Is Not the True Regulative Force.

It is supposed by many who discuss municipal affairs that the granting of competitive franchises for public-service work is the true means of obtaining for users the lowest possible price for the service rendered, whereas, as a matter of fact, the exact opposite is the ultimate result. This is proved by results in all large cities where the most severe competition has taken place. Acute competition necessarily frightens the investor, and compels corportations to pay a very high price for capital. The competing companies invariably come together, and the interest cost on their product (which is by far the most important part of their cost) is rendered abnormally high, partly owing to duplication of investment and partly to the high price paid for money borrowed during the period of competition.



STERLING ARC LAMP COMPANY'S EXHIBIT AT CHICAGO CONVENTION.

The selling price of a service should be based on its cost, and in any business such as public work, where the investment is large and the annual turnover is comparatively small, if the item of interest be unnecessary augmented, it must be reflected in the price paid by public and private users.

While it is not supposed to be popular to speak of exclusive franchises, it should be recognized that the best service at the lowest possible price can only be obtained, certainly in connection with the industry with which we are identified, by exclusive control of a given territory being placed in the hands of one undertaking. In most European countries public-service operations enjoy exclusive franchises, under proper control, and are able to obtain capital for their undertakings at the lowest commercial rates, thus materially affecting the cost of their product, of which interest, as I have already stated, is necessarily so great a part. In order to protect the public, exclusive franchises should be coupled with the condition of public control, requiring all charges for services fixed by public bodies to be based on cost, plus a reasonable profit. It will be found that this cost will be reduced in direct proportion to the protection afforded the industry. The more certain this protection is made the lower the rate of interest and the lower the total cost of operation will be, and, consequently, the lower the price of the service to public and private users. If the conditions of our particular branch of public service are studied in places where there is a definite control, whether by commission or otherwise, it will be found that the industry is in an extremely healthy condition, and that users and taxpayers are correspondingly well served.

Compensation for Franchises

When prices for services are based on cost it matters not whether in the establishment of a system of legislative control provision is made for paying a portion of the receipts direct to the municipality. If the public demands a percentage, surely we can afford to pay it, as it would simply be added as an item of expense on which our selling price would be figured. If the public does not demand a percentage, this selling price would be proportionately less. It is simply a question as to whether our municipal bodies prefer to raise a portion of their income by taxing their citizens through the agency of public-service corporations, or whether they prefer to raise that portion of their income by collecting it direct from citizens themselves. Revenue raised by a percentage on gross receipts of the electric-lighting business would, at the present time, however, seem to be somewhat unfairly obtained in cases where the selling price is subject to legislative control and based on cost of service, as the result would be that a small minority of citizens using electricity would be forced to contribute largely to the public revenue, whereas the benefits enjoyed therefrom would be to the advantage of the whole community.

Taking Private Property for Public Use

Another point that should be included in a proper scheme of public control is a condition under which the municipality would have the right to purchase the undertaking. Such a right should include a direct obligation on the part of the municipality to purchase the property at a fair price whenever it is thought desirable that the industry should be operated by the municipality. The possibility of the exercise of the right of purchase by the municipality would of itself make it to the interest of the owners of the property to do their full duty in their relations to the public. On the other hand, if a com

munity licenses a corporation to perform a certain public service, and if that corporation invests its money and develops its business, surely it is unfair for that community to go into the same line of public-service work itself without first purchasing the existing plant. If this is not done the value of private property will be destroyed without just compensation being made therefor in an attempt to secure a public benefit. I do not believe that the people, as a whole, are so unfair as to demand that such a course be taken.

My recommendations on the subject, which I have just presented, are by no means original. Most public-service corporations in Great Britain are run on practically the basis indicated, and in more than one state in the union corporate legislation has taken the same direction.

I would summarize the position which I think we should take on this subject in just two sentences.

First—Franchises granted to public-service corporations should secure them the same degree of protection in their rights to their property as is enjoyed by other investments.

Second—Public control of charge for service based on cost, plus a reasonable profit, and eliminating the factor of competition, is the proper safeguard for the interests of users, taxpayers and investors.

At the conclusion of the reading of this address the regular order of business was taken up.

COMMUNICATIONS.

The president read letters of regret from the first vice-president, A. M. Young of Waterbury, Conn., Thomas A. Edison, Nikola Tesla, Professor Bovey and Prof. Thomson, who were unable to be present.

Invitations to accept the hospitalities of the following-named companies were read: Metropolitan West Side Elevated, South Side Elevated, Northern Steamship company, asking the members to "inspect" the Northwest. An invitation for the association to meet in Detroit next year was also read. The Chicago Telephone company announced that it had placed a special telephone in the rooms of the local reception committee for the use of the members and visitors. The American Telephone and Telegraph company announced that it had also placed a long-distance instrument at the disposal of the members and visitors.

PAPERS AND DISCUSSION.

The president then announced the next order of business to be the paper by Calvin W. Rice of Brooklyn, on "Cost of the Generation and Distribution of a Unit of Electricity." Several interesting diagrams were shown in connection with this paper. In the discussion that followed, President Insull produced a chart showing an analysis of the business of the Chicago Edison company, the relative importance of the several classes of business and the result of the company's experience in furnishing this service. The topic "Prices and Discounts for Electric Current and Methods of Billing Current to Customers" was considered in the same connection. Mr. Dow and Mr. Ferguson gave some interesting information on the subject of meters, and Mr. Wagner also participated. Mr. Weeks, Mr. Barker, Mr. Ayer, Mr. Scoville and Mr. Creden contributed to the general discussion, which was formally closed by Mr. Rice. This session had been prolonged until 1:30 p. m., so great was the interest manifested in the discussion, and it was determined accordingly, to adjourn until 3 p. m. Before the members withdrew, however, President Insull took occasion to commend the gentlemen in attendance for the attention they had given the papers, and he urged them to be present at the remaining sessions, promising that they would find the papers and discussions both profitable and entertaining.

When the convention was again called to order in the afternoon, President Insull announced the first paper to be that of Alex Dow of Detroit on "Public Lighting with Relation to Public Ownership or Control." This paper was followed by addresses on the same subject by Samuel Scovil of Cleveland, H. M. Atkinson of Atlanta and E. H. Davis of Williamsport, Pa., which are presented elsewhere in this issue.

At the conclusion of the reading of these papers the meeting adjourned to executive session.

Wednesday's Proceedings.

President Insull called the meeting to order at 10:30 a. m. and announced that the papers for the morning session would be on "General Distribution from Central Stations by Alternating Currents," by Herbart A. Wagner of St. Louis, and "General Distribution from Central Stations by Direct Currents," by Louis Bell of Chicago. The papers were read by the respective authors.

The president: I have pleasure in calling upon Prof. Fujioka, one of our honorary members, who is professor of electrical engineering at the Imperial University of Tokyo, Japan.

ELECTRICAL DEVELOPMENT IN JAPAN.

Prof. Fujioka: Although I have the honor to be an honorary member of your association, I have had very little opportunity to attend your conventions. I shall take great pleasure this morning in giving a short description of the plant and system which has been carried out under my direct supervision in Japan. I have no data, to be compared with the papers which have been read, so I will draw a rough map of Tokyo. We originally had five central stations. No. 1 station was originally installed in 1888 entirely with the Edison three-wire system; Nos. 2, 3, 4 and 5 were installed afterward, also on the Edison three-wire system. Before going further I would like to say that there are some conditions peculiar to Japan that had to be taken into consideration. The city of Tokyo has quite an extended area, occupying about 100 square miles, and the buildings are scattered, but we have no high buildings because of the danger from earthquakes. I saw the advantages of the Edison three-wire system of distribution, so we began to supply the more crowded parts of the city by means of the three-wire system. We subsequently found that it was necessary to supply current to more scattered parts of the town, so we added single-phase alternating currents in most of the other stations. Since we saw the advantages of the three-phase current transmission we have decided to install one big power station near the river. All the former stations were worked with high-pressure non-condensing engines, and I may state that coal in Japan, particularly in Tokyo, is very expensive, costing $5 to $6 per ton. So we found that it might be wiser to install a condensing station near the river, having triple-expansion engines. We installed ten triple-expansion engines on the condensing system, each engine directly coupled to low-speed generators, four of them single-phase and six of them three-phase generators. The three-phase generators were wound for 3,500 volts, whereas the single-phase were wound for 2,000 volts. We did not like to disturb the existing three-wire network in the crowded

WESTINGHOUSE HEADQUARTERS AT CHICAGO CONVENTION.

portion of the city, and we wanted to keep the three-wire network as we have had it for about ten years. The way I have done it was to place induction motors in No. 1 station, taking out all the engines and boilers, and placing the induction motors in the same place as we had the engines. So in the same way station No. 3 was converted in a similar way, and in station No. 2 we have four induction motors, each 150 horse power, directly connected to multipolar direct current dynamos. No. 4 station was taken down altogether. In No. 5 station we took down all the old engines and dynamos, and replaced with three-phase transformers with the four-wire system for alternating current. The other parts are coupled by means of 2,000-volt single phase currents, raising the voltage at the necessary place to the required potential. In that way we have succeeded in reducing a great deal of the expense in fuel and labor items. I cannot tell at present the exact proportion of the decrease, but we know we have reduced the expenses materially, and I shall be much pleased if this brief description will convey to you some idea of what has been done in Japan.

GENERAL DISTRIBUTION SYSTEMS.

President Insull announced that the general subject of alternating currents and direct currents for electric lighting and power was open for discussion, and an animated debate followed. Among those who participated were Messrs. Thayer, Wurts, Bump, Robinson, Dow, Wilmerding, Scovil, Rice, Pillsbury, Ayer, Fakes, Davis, Stetson, De Camp, Hubeley, Chandler, South, Walbank and Carnes.

It was found necessary to adjourn before concluding this discussion, and the subject was again taken up in the afternoon. President Insull took the floor during the afternoon and made a very interesting address on the commercial features of the problems, and Messrs. Ferguson and Wagner were called upon to elucidate some point raised or reply to the criticisms on the respective systems advocated. The convention adjourned until Thursday morning, when the discussion was finally concluded.

Thursday's Proceedings.

President Insull called the meeting to order at 10:40 a. m. The first paper read was on the "Cost of Producing Electric Power by Water Power from the Lachine Rapids, Canada," by W. McLea Walbank of Montreal, Canada. In the discussion which followed the reading of this paper, Messrs. Wagner, Ferguson, Insull, Fakes, Davis, Matlock, Rice, Anderson and Walbank discussed the several points involved.

The president then introduced Prof. W. E. Goldsborough of Purdue University, Lafayette, Ind., who read an interesting paper on "Transformer Economy." Mr. Layman led the discussion on this subject, and was followed by Messrs. Thayer, Wurts, Wagner, Davis, Matlock and Walbank.

NOMINATING COMMITTEE.

The president: I beg at this time to announce the committee to nominate officers and members of the executive committee for the ensuing year. I will appoint as a nominating committee the following-named gentlemen: A. M. Robertson, Minneapolis, Minn.; James R. Dee, Houghton, Mich.; James L. Ayer, Boston, Mass.

The closing session of the convention was held on Thursday afternoon, and, like all other sessions, was well attended. President Insull called the members to order for the last time at 2:55 p. m.

COMMITTEE REPORTS.

The first business was the report of the committee on "Standard Candle Power of Incandescent Lamps," of which Dr. Louis Bell was chairman. Mr. Ayer presented the report of the committee, as follows:

"Your committee has been able to have tested in the most careful manner, through the courtesy of Prof. W. L. Puffer of Boston, 16 incandescent lamps from 11 different makers. The lamps were obtained directly from the makers or their authorized agents and were known to be for test.

"These lamps were all sold for 16 candle power 110 volts, no watts specified, and may be fairly assumed to represent the product which would be shipped to consumers who did not desire the lamps for test, although one batch of lamps came with the bases marked, to show the point to be turned toward the photometer screen.

"On test these lamps, 33 in all, averaged 14.1 mean normal candle power and about 11.7 mean spherical candle power. Only one batch of three averaged over 16 normal candle power. One batch fell below 11 normal candle power, and two below 12 normal candle power. Five makers fell below 14.5 normal candle power. The highest average of any batch was 16.09, the lowest 10.82. The average consumption of energy was almost exactly four watts, the lowest 3.78 watts per candle, and two batches ran over five watts. It should be noted that the voltage was determined by a Weston voltmeter, freshly compared with Clark cells, and each lamp was marked at its voltage (110).

"A separate series of tests showed that these lamps on the average gave their mean spherical candle power, when measured under rotation, with their axes tilted 45 degrees until 30 minutes from the vertical toward the photometer, thus confirming closely

your committee's estimate of 45 degrees as a proper angle.

"A series of tests on proper speed of rotation showed that the best results were obtained with a speed of 200 to 250 revolutions per minute, and that the lamps would readily stand this speed.

"Many of the lamps showed bad spherical distribution, which seems to be quite needless, since it is merely a matter of proper proportioning the form of the filament.

"Of an equal number of batches of 32 candle power lamps only one batch averaged 32 normal candle power, the majority falling to from 26 to 28 candle power. The 32 candle power lamps averaged slightly greater efficiency, but were otherwise much like the 16 candle power size.

"From this investigation the fact stands out that the incandescent lamp sold for 16 candle power is, on the whole, a lamp which is often giving considerably less than its rated candle power, even when new. Some of these lamps would probably show a temporary increase of candle power, after, say, 50 hours' burning, but the committee has not extended the research in this direction as yet, and adheres to the opinion that the initial candle power is the only practicable commercial test, and any increase, consequently, is simply to be regarded as a device for keeping the lamp a little longer from its inevitable decay.

"From these and other data kindly furnished by manufacturers, and obtained from various other reliable sources, your committee is convinced that the need of a uniform rating is even greater than it concluded in the preliminary report of last year, and that a rating test, in order to be effective, must involve measurement of candle power of lamps in more than one direction. Neither mean horizontal nor mean spherical candle power, nor candle power in any one direction, will define a lamp well enough to insure adherence to the rating. Your committee, therefore, recommends that incandescent lamps be required to conform both to a standard mean normal candle power and to a mean candle power when revolved with the axis tipped 45 degrees, this representing the spherical distribution. It recommends that the limits for the mean normal candle power be 15 and 17.5 candle power. Unless the minimum be as high as 15 there will certainly be found a tendency to produce lamp near the lower limit. The 45 degrees candle power should be at least 85 per cent. of this minimum. This is not an excessive requirement, and will tend to prevent working near the lower limit of horizontal candle power, unless with a lamp very good in other respects.

"Your committee has blocked out a standard form of photometer, a type of which it proposes to build, to test and put at the disposal of the association, with directions for proper use.

"It is suggested that testing be by sample, a lot of 10 lamps being taken from each barrel. Of these no lamp when run at its marked voltage shall show less than 15 nor more than 17.5 candle power, mean horizontal, when rotated at 200 to 250 revolutions per minute, and no lamp shall give when thus rotated at 45 degrees inclination less than 85 per cent. of the above minimum.

"The committee will make arrangements for standard lamps as indicated in the preliminary reports to go with the standard photometer."

Mr. Rudd said: I move that the report of the committee be adopted, that this committee be discharged and another committee be appointed to continue the work.

The motion was carried, and the president appointed as a committee: Chairman, James I. Ayer of Boston; Louis A. Ferguson of Chicago and Calvin W. Rice of Brooklyn.

The committee on "Amendments to Freight Classification" requested further time to report, and the matter was postponed until the next meeting.

The committee on "Legislation Concerning Theft of Current" made a verbal report, in which it stated that the committee had collected laws passed in 27 different states, bearing on this subject, and recommended that the same be published for the benefit of the members of the association.

The recommendation of the committee was adopted, and a new committee was formed, as follows: Chairman, E. A. Armstrong of Camden; James I. Ayer of Boston and A. W. Field of Columbus.

Miscellaneous Business.

The meeting then adjourned to executive session.

The report of the secretary and treasurer was presented, showing the affairs of the association to be in a flourishing condition.

Place of Meeting.

On motion of Mr. Armstrong, the following resolution was adopted:

"Resolved, That the annual meeting shall be held in May or June in each year, alternately in the cities of New York and Chicago, unless otherwise directed by the executive, and on such date as the committee shall determine."

FIG. 1. CENTRAL ELECTRIC COMPANY ON FIFTH AVENUE.—SALESROOM.

Resolution of Thanks.

On motion of Mr. Atkinson a vote of thanks was passed to President Insull for his untiring efforts for the success of the Chicago convention.

Mr. Ayer moved that the thanks of the meeting be extended to the Chicago Edison company, the Metropolitan West Side Elevated road, the South Side Elevated road, the Northern Steamship company, the Chicago Telephone company, the American Telephone and Telegraph company and all others who had extended courtesies to the convention, for their kindness in so doing.

Mr. Field moved a vote of thanks to the reception committee for their very considerate attention to the ladies accompanying the delegates to the convention.

Election of Officers.

The following-named officers were elected for the ensuing year:

President—A. M. Young, Waterbury, Conn.

First vice-president—E. H. Rollins, Denver, Colo.

Second vice-president—F. A. Gilbert, Boston, Mass.

Members of the executive committee—Samuel Insull, Chicago, Ill.; Samuel Scovil, Cleveland, O.; H. M. Atkinson, Atlanta, Ga.; F. A. Copeland, La Crosse, Wis.

The convention then adjourned sine die.

Social Features.

The preliminary reception tendered to members and visitors by the local electrical interests at the Auditorium Hotel on Monday evening was the principal social event of the meeting and proved to be a most enjoyable affair. Many of the eastern members had arrived and there was a large delegation from the West and Northwest. The Chicago electrical fraternity was also well represented and there were many ladies present. The rooms were beautifully decorated and excellent music was furnished for dancing. Refreshments were served in an adjoining room, and the evening passed very pleasantly.

The coaching party on Tuesday was thoroughly enjoyed in spite of the shower which at one time threatened to spoil the day's pleasure. Three coaches filled with ladies attending the convention started from the Auditorium Hotel at 11:30 a. m. The visitors were taken through Michigan avenue, Grand, Oakland and Drexel boulevards, Washington and Jackson Parks, to the Washington Park club-house, where luncheon was served. The following-named ladies comprised the party:

Miss Bissicks,	Mrs. White,
Miss Milligan,	Mrs. Cutter,
Miss Sutherland,	Mrs. Cutler,
Miss Bissicks,	Mrs. Morse,
Miss Coney,	Mrs. Tucker,
Miss Wiley,	Mrs. Low,
Miss Lancaster,	Mrs. Donohoe,
Miss C. Schayer,	Mrs. Perry,
Miss Ferguson,	Mrs. Harrington,
Miss Cheney,	Mrs. Wetzler,
Miss Slatt,	Mrs. Asher,
Miss Rhue,	Mrs. O'Hara,
Miss Meyers,	Mrs. Geraghty,
Miss A. Schayer,	Mrs. Kreidler,
Mrs. Smith,	Mrs. Sunny,
Mrs. Bailey,	Mrs. Buell,
Mrs. Thayer,	Mrs. Keily,
Mrs. Scribner,	Mrs. Williams.
Mrs. Freeman,	

Convention News and Gossip.

W. H. Schott and W. B. McDonald of Chicago were two practical representatives of the new Commonwealth system of central stations.

Five ex-presidents were in attendance—Weeks, Huntley, Ayer, Armstrong and Wilmerding. They received the attention their honors merited.

Mr. A. E. Lang, president of the American Street Railway association, was an interested visitor. Mr. Lang's company in Toledo controls a monopoly of the street-railway and lighting business of the town.

One of the foreign visitors was Mr. E. Dysterud, the superintendent of the Electric Light and Power company of Monterey, Mexico. Mr. Dysterud also reserved steamer accommodations for the Northwestern trip.

There was not a great deal of war talk at the convention, but the observant ones noticed with satisfaction, nevertheless, that on the covers of the official programme the national colors were securely fastened over Manila.

Miss Billings, the faithful coadjutor of Secretary Porter, was as cheery and obliging as ever. Her work has much to do with the smooth running of the conventions of the National Electric Light association, and it is always well done.

J. M. Hill was indefatigable in his work of promoting the Northwestern steamer convention. He was ably supported by President Copeland and Secretary Mercein of the Northwestern association and a considerable delegation of the members of that organization.

Luther Stieringer speaks in glowing terms of the effectiveness of the electric-lighting effects obtained at the Omaha exposition. The conditions, he says, were very favorable, and the management, with the example of the World's Fair in view, was quick to take advantage of its opportunity.

Joseph Wetzler lectured on "Electricity Direct from Coal," in the assembly room on Wednesday evening. The lecture was illustrated by stereopticon views, and was followed with interest by an audience that tested the seating capacity of the hall. Mr. Wetzler had an interesting subject, and he handled it with ability.

"Livsey's hat" became Livsey's pride before the convention was over. Mr. Livsey wore a white crush hat in the hotel, and someone conceived the idea of inscribing autographs on it. It is now covered, inside and out, with the signatures of convention visitors, sketches and caricatures. Mr. Livsey sets great store by his unique souvenir.

Calvin W. Rice, whose portrait is printed on page 341, made a favorable impression, not only in the manner in which he handled the subject of "Cost of the Generation and Distribution of a Unit of Electricity," but in the subsequent discussions. Mr. Rice is electrical engineer for the Kings County Electric Light and Power company of the borough of Brooklyn.

During the convention days no visitor could progress very far in or near the Auditorium without running into a Chicago Edison man. The "boys" of Mr. Insull's company were naturally out in force. They were very much interested in the convention, and a very large share of its success is due to their untiring efforts to make everybody satisfied, comfortable and happy.

The meeting room was none too large. It was the handsome banquet hall of the Auditorium, and there were few vacant chairs at any of the sessions. About 200 persons could find seats, but there were often listeners standing in the back of the hall. The sustained interest and high percentage of working attendance to total attendance form a high-water mark in the history of the association. President

Insull cast the whole weight of his influence for a working convention, and was well entitled to the congratulations he received.

One of the impromptu features of the convention was a hurriedly arranged theater party on Wednesday evening. This was a "stag" party, and over one hundred of the men occupied the front seats of a variety theater, and enjoyed the "gags" on the electrical men interpolated by the performers. The hosts of the occasion were the six members of a "syndicate" of Chicago and St. Louis men, who devised the affair for the entertainment of their friends.

Mr. F. C. Armstrong, who attended the convention, announced to his friends his departure for England on June 22d. Until lately Mr. Armstrong was the general agent of the Canadian General Electric company in Toronto, but he has joined the commercial staff of Dick, Kerr & Co., the English tramway contractors. Mr. Armstrong will be the manager of the electrical sales department of this important firm in London. In view of the awakening to the value of the electric-railway system now seen in many of the countries of Europe, Mr. Armstrong is looking forward to a career of activity and usefulness.

FIG. 2. CENTRAL ELECTRIC COMPANY ON FIFTH AVENUE. —OFFICES.

There were two coaching parties for the ladies. Both were interfered with to some extent by rainy weather, but in neither case could the elements successfully compete with the high spirits of the ladies. The first trip was taken on Tuesday. The party, consisting of about 40 ladies and an escort of five valiant gentlemen, left the Auditorium shortly before noon in three coaches and a carriage. Dodging heavy showers with more or less success, it finally reached the Washington Park Club, where an elaborate lunch was served. Here the ladies enjoyed themselves thoroughly, and it was unanimously decided that all had had "a good time," despite the rain. The arrangements for the outing were made by Messrs. Frank Gorton and John Jay Abbott of the Chicago Edison company, and they were thoughtfully planned. Mr. Gorton is the chairman of the house committee of the Washington Park Club. The second coaching party was given on Thursday afternoon, when the ladies were driven through Lincoln Park.

Two Japanese electrical men attended the convention. One is Prof. I. Fujioka of Tokyo, professor of electrical engineering in the Imperial College of Japan and president of the Electric Light association of Japan and the Tokyo Electric Light company. The other is Mr. Seuchi Hirota, also of Tokyo, where he is connected with the electrical importing firm of Takata & Co., of Tokyo, London and New York. Both gentlemen took an intelligent interest in the proceedings of the convention, and Prof. Fujioka participated in Wednesday's discussion of the relative merits of alternating and direct currents. When he rose to speak, Prof. Fujioka received a very cordial welcome. He described the central-station situation in Tokyo, illustrating on a blackboard the location of

FIG. 3. CENTRAL ELECTRIC COMPANY ON FIFTH AVENUE. —OFFICES.

[*Continued on page 349.*]

The Central Electric Company on Fifth Avenue.

Chicago is large; it is growing and will be larger; and, as the electrical business has been going through a similar process, it is safe to assume that Chicago is to be the prime electrical distributing center of the United States. Chicago can lay claim to having the best appointed, best arranged and probably the largest strictly electrical supply house in the world, that of the Central Electric company. This concern has just become thoroughly settled in its new location, 264, 266, 268 and 270 Fifth avenue, and a brief description of the new quarters will be interesting.

The facilities of the company's previous location at 173 and 175 Adams street, having proven inadequate to enable it to handle the constantly increasing trade, a new location was secured and entirely remodeled in a manner adapted to the company's requirements. This location is ideal in many respects, situated in the wholesale district on the line of the elevated-railway loop, between Jackson boulevard and Van Buren street, and convenient to all freight depots. The building is of modern construction, having a frontage of 180 feet on Fifth avenue and a depth of about 140 feet. One cannot miss the location, as the large Okonite sign (always associated with the Central Electric company) on the top of the building can be seen the entire length of the avenue. It is a compliment to the foresight in planning and the organization maintained to state that the large stock was moved to the new location in such a systematic manner that no delay was occasioned in making regular shipments, and the great amount of work necessary for making this record of prompt shipments under these trying conditions cannot be understood except by one who has passed through the experience.

The view on entering the building is shown in Fig. 1, which represents one-half the store or retail department. The counters extend down the right-hand side. Back of them are shelves with numerous drawers, shown in part in Fig. 3. All of the shelves and counters are constructed of quarter-sawed oak highly finished, and they present a handsome appearance. The retail department, which is also the house-goods department, is presided over by Mr. F. M. Pierce, a veteran in the business, who enjoys a large acquaintance among buyers of electrical material. In this department is to be found a multitude of various supplies used in the domestic applications of electricity, in telephony and much of the more extensive material used in the various other branches of electrical work, all arranged on the shelves and in cases in such manner that the "goods almost sell themselves." In the foreground (Fig. 1) is seen a table on which are displayed samples of the various types of fan motors. To the right of the entrance is a large board on which are arranged electrical testing instruments of various kinds, and a marble slab containing three of the latest types of Wagner switchboard instruments is very prominent. To the left are displayed various types of Lundell power motors and Wagner transformers.

Fig. 2 shows the location of the executive offices, accounting and general sales departments. These departments occupy the entire front of the first floor excepting the main entrance, and are arranged with the intention of utilizing the daylight, as well as in such a manner as to facilitate the rapid handling of the business. The offices to the left in the picture are occupied by Mr. Charles E. Brown, the secretary, Mr. George A. McKinlock, the president, and Mr. S. R. Frazier, the treasurer, in the order named. A spacious office between those of Mr. McKinlock and Mr. Brown is reserved for their private stenographers. The open offices to the right are occupied by Mr. H. F. Conley, city salesman, Mr. J. M. Knox, special salesman, Mr. Charles G. Burton, general salesman and advertising man, and Mr. F. D. Lempke, chief order clerk, in the order given. The cashier's office is at the end of the aisle. Fig. 3 gives another view of these departments, taken from a point near the cashier's window. All of the woodwork is of quarter-sawed oak and presents a very light and airy appearance.

To the left of the retail department and in the rear of the offices and accounting department is the first-floor stock room, extending across the building, and it is here that the first glimpse of the machinery or system necessary for handling the large quantities of the various articles incident to the business is seen. It is a simple organization, systematized into a definite place for everything, with everything in its place. In this department are bins, each one properly labeled and containing its definite article. These are built in tiers reaching nearly to the ceiling, the construction being shown in part in the left of Figs. 1 and 3. If these bins were placed end to end they would extend three-fifths of a mile. Here are found all of the lighter articles, sockets, cutouts, switches, house goods of all kinds, street-railway supplies, incandescent lamps, glassware, small wires, the smaller sizes of Okonite products (120 bins being devoted to the Okonite products alone), and in addition to these ample floor space is found for all original packages. This arrangement enables the stockkeeper to be constantly informed of the condition of the stock in his charge and also makes prompt shipments easy. The stock-room is separated from the shipping and receiving room in the rear by a partition which extends to the ceiling and which is very effective in keeping out the dirt and dust incident to the packing of goods.

The shipping room, a partial view of which is shown in Fig. 4, occupies the entire rear of the building and opens on a large rear platform in the alley. While the room is spacious, it is none too large for the amount of material handled. It is supplied with all of the conveniences necessary to the receiving and shipping of material, and is an excellent barometer of the condition of affairs in general. Here, as everywhere else about the establishment, is evidence of a system and organization that brings order out of what, perhaps, to the uninitiated, is chaos.

One does not have much of an idea of the quantities of bulky material necessary to have constantly

FIG. 4. CENTRAL ELECTRIC COMPANY ON FIFTH AVENUE. SHIPPING ROOM.

on hand in order to make the claim of being able to "ship from Chicago stock," until a visit is made to the basement of this establishment. In it are cross-arms, pins, insulators, glass jars, wire (tons upon tons) and conduit, iron fittings of all kinds. It is frequently remarked that a good electric wireman must be a "jack of all trades," and it is equally true, apparently, that an electrical supply house must be a department store, as so many articles not strictly of an electrical nature are carried in stock in this basement, as well as in other departments. The basement is unusually large and has a capacity of 35 carloads of material. A partial view is given in Fig. 5. This picture indicates the extent of stock carried. The basement is provided with a chute from Fifth avenue and a hoist to the shipping room and alley; it is lighted with Luxfer prisms and is provided with other conveniences for the handling of material.

The personnel of this company is so widely known that mention may be somewhat superfluous. Mr. George A. McKinlock, the president, has been identified with this company since its inception, in 1887, and its present condition and standing are undoubtedly due to his business sagacity and foresight. No one can meet Charles E. Brown, the secretary, without being impressed with his capacity for hard work and the extent of his marvelous knowledge of the intricate details of the electrical-supply business. Mr. S. R. Frazier, the treasurer, who has been associated with this company for about two years, is a man of recognized financial ability, and brings

FIG. 5. CENTRAL ELECTRIC COMPANY ON FIFTH AVENUE. —STOCK IN BASEMENT.

to the company years of experience in a similar position.

The Central Electric company has made for itself an enviable reputation for solidity and clear business sanity. It is one of the bulwarks of the electrical industry in Chicago, and, having won its pre-eminence by fair and honorable means, everyone will wish for it a continuance of the steady and healthy growth of past years.

H. P. Stow of the Gold Bank mine proposes installing an electric light service for the mining camps of Forbestown, Cal. The current will be supplied from a generator located at the mine.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The Chicago convention of the National Electric Light association may be said to have marked the beginning of a new era in the history of the organization. The meeting last week had a better attendance of central-station managers and engineers than former gatherings of the same body, and the interest manifested in the proceedings was sustained throughout. President Insull is to be congratulated upon the success which attended his efforts in arranging and directing the proceedings. Every session of the convention was well attended, some of them taxing the capacity of the assembly room, while the smallest gathering during the week was larger by far than the usual attendance at former conventions.

It was evident that the association had entered upon an era of greater usefulness, and that it had taken a new lease of life. It is to be hoped that the impetus given the organization by the Chicago meeting will not be lost.

The association is to be congratulated upon having selected for the ensuing year a presiding officer who has long been in sympathy with the body. Under his able leadership it is hoped that the National Electric Light association will thrive and flourish and become an influential factor in forming public opinion and promoting the public welfare. The Western Electrician, on behalf of the electrical fraternity of the West, extends to President Young assurances of support and hearty co-operation in every movement tending to advance the interest of the organization and the electrical industry.

The convention of the Illinois Street Railway association in Chicago during the week was an interesting meeting and should lead to good results. The association is gaining prestige, and its membership is growing constantly.

The action of the National Electric Light association in naming New York and Chicago as the places of meeting will certainly meet with general approval. The wisdom of such a course is proven by the fact that former meetings of the association held in these cities have been the most successful gatherings of the organization. Another feature that had considerable weight in the matter was the growing tendency to make the annual conventions strictly business gatherings. The days of junketing have passed, and the electrical fraternity of to-day does not wish to revive them.

An influential organization, known as the New Hampshire Development association, has determined to take an active part in state politics, with the view of overcoming the influence exerted by existing corporations. In its declaration of principles it says: "We believe the people should have the right to build steam or electric roads, when the capital has been subscribed in good faith, and the construction is desired by a majority of the legal voters of the towns through which the roads are to be built, limiting the amount of capitalization to the amount actually paid in for legitimate expenses in building the roads."

The attitude of existing corporations throughout New England, particularly steam-railroad companies in restricting competition has had the effect of provoking opposition to this class of enterprises.

We have always maintained that Henry C. Payne of Milwaukee was a wonderful man and that his genius was not fully appreciated by his conservative townsmen, and now we are more firmly convinced than ever that he is wasting his time in the Wisconsin metropolis, as people of that section call their thriving and thrifty city. Colonel Payne convinced Judge Seaman of the United States Circuit Court recently that his company could not comply with the requirements of the four-cent fare ordinance passed by the council a year ago, without inviting bankruptcy. The court, therefore, declared the ordinance invalid and it was the general belief that this would not only terminate the controversy but would mean indefinite continuation of the present five-cent fare regulation. But the colonel willed otherwise, if reports be true, and he has declared that he will voluntarily do that which he refused to be coerced into doing. And he adds that he would have done it long ago if the city had not tried to compel him. He invites attention to the fact, too, that the company will not suffer financially by the change. He is going to reverse the old saying: "First he said he would and then he said he wouldn't." Judge Seaman said it couldn't be done, but Henry C. Payne now says it can, and it is dollars to doughnuts that Henry knows more about it than the judge.

There are all sorts of cranks in this world. One class would exclude from public service distinguished citizens who, through exceptional ability, have attained prominence and won the respect and confidence of the community. It must have been one of these who introduced a bill which is now pending in Congress providing that it shall be unlawful for the director of any railroad, telegraph or express, steamship or telephone company, national bank or any member or officer of any combination or association formed for the purpose of controlling the price of any article of commerce to hold the office of president of the United States, sit in the cabinet, qualify as United States senator, representative in Congress, judge of any United States court or to be the head of any department or bureau of the government. It is explained that this measure is aimed at trusts, but it should be apparent to everyone that if enacted and enforced it would simply deprive the government of the services of many able and faithful public men whose honesty and patriotism have never before been questioned, although they have not been proclaimed as noisily and as constantly as the professions of those who encourage such legislation.

President Insull's opening address at the convention of the National Electric Light association, which has just closed, was one of the ablest documents that has ever been presented for the consideration of that organization. It revealed a thorough knowledge of the methods employed and the conditions that obtain in the electrical field to-day, as well as a familiarity with the inner history of the development of the electric-lighting industry of the country.

The remarks on the necessity of closely adhering to standard apparatus and avoiding the use of special machinery, except where absolutely necessary, are based upon experience both as a manufacturer of apparatus and user of machinery. The suggestion that the association co-operate with the American Institute of Electrical Engineers should be acted upon at once. The experience of these two organizations in leading the movement for improved construction and the adoption of a higher standard of material should encourage them to undertake the present work. It is certainly an important matter, and an intelligent consideration of the problem should lead to beneficial results.

The second division of the paper was devoted to the subject of "Selling Price Based on Cost." Mr. Insull's observations were in line with the policy laid down in his excellent paper on "Development of the Central Station," which was published in the Western Electrician last week, and substantially relates the experience of the Chicago Edison company in disposing of its product.

By far the most important feature of the address, however, was that portion dealing with the subject of municipal ownership or control of electric-lighting and similar corporations. Mr. Insull took the broad view that local governments granting special privileges to corporations had the right and were in duty bound to safeguard the interests of taxpayers, and that they should exercise a certain degree of control over such enterprises. On the other hand, he contended that private capital could furnish better and cheaper service than municipal plants, and he vigorously opposed the establishment of a municipal plant in competition with one operated by a corporation, or any other policy that would jeopard private capital. If the relations of corporations of this character and communities were clearly defined and thoroughly understood he believed that the most serious of the misunderstandings would be cleared away. Long-term, exclusive franchises under proper restrictions would ultimately be accepted as the solution of the problem, he predicted. This part of the address has already attracted widespread interest and has called forth many favorable expressions.

WAR NEWS.

Legal Aspect of Cable-cutting.—Among a number of English contributions to the discussion of the legitimacy of cable-cutting in war time is a letter from Prof. T. E. Holland of Oxford, in the London Times. This authority considers the general relations of neutrals and belligerents, and concludes that the well-established principles of internationl law are perfectly applicable to the case. He concludes as follows: "Telegraphic communication with the outside world may well be as important to a state engaged in warfare as similar means of communication between one point and another within its own territory. Just as an invader would, without scruple, interrupt messages, and even destroy telegraphic plant, on land, so may he thus act within the enemy's territorial waters, or, perhaps, even so far from shore as he could reasonably place a blockading squadron. It may be objected that a belligerent has no right to prevent the access of neutral ships to unblockaded portions of the enemy's coast on the ground that by carrying diplomatic agents or dispatches they are keeping up the communications of his enemy with neutral governments. But this indulgence rests on the presumption that such official communications are "innocent," a presumption obviously inapplicable to telegraphic messages indiscriminately received in the course of business. It would seem, therefore, to be as reasonable as it is in accordance with analogy that a belligerent should be allowed, within the territorial waters of his enemy, to cut a cable, even though it may be neutral property, of which the terminus ad quem is enemy's territory, subject only to a liability to indemnify the neutral owners. The cutting elsewhere than in the enemy's waters, of a cable connecting enemy with neutral territory, receives no countenance from international law. Still less permissible would be the cutting of a cable connecting two neutral ports, although messages may pass through it which, by previous and subsequent stages of transmission, may be useful to the enemy." It is always to be remembered, however, as Professor Holland observes, that international law is "no cut-and-dried system, but a body of rules founded upon, and moving with the public opinion of nations."

Effect on the Copper Market.—It happens that the United States and Spain are the two principal copper-producing countries of the world, and it is therefore possible that the war may have an effect on the price of this important metal. For the last few years the demand for copper has been brisk and the price has been stiffly maintained. In the United States the average price during the year 1897 was over 11 cents a pound. The production was 510,190,719 pounds, or 227,764 long tons. This is considerably over half of the entire production of the world, which, for 1897, is fixed at 396,723 tons by a competent English authority. The stocks on hand are said to be low all over the world, and an English contemporary thinks that a copper famine "is quite within the bounds of possibility." Considering the extent and location of the American sources of supply alone, it does not seem possible that the fear of an actual copper famine is well founded. However, a further advance in price, if the war should be of considerable duration, is possible, owing to the real or apprehended shrinkage of the foreign output.

Cable-cutting.—A dispatch from Washington on June 8th said: "It was positively established to day that the French cable running from Santiago to Cape Haytien went out of service last Friday and remained out of working condition until Saturday. During the 24 hours' interruption the cable company was unable to carry any business over this line. There is little doubt the interruption was due to the work of the cable-cutting ship sent out by General Greely and in charge of signal-service officers. The French cable began working again Saturday. How this came about is beyond explanation by the best cable experts. The French Cable company is said to be as much in the dark on this point as are the authorities here. All that the company knows is that it could not do business from June 3d to June 4th. The matter is further complicated by reports that the cable again stopped working at midnight Monday. The condition of this cable is regarded as important, as it is one of the means open to General Blanco in his communication with the Spanish authorities."

Cable Restrictions.—It is now claimed, but with doubtful authenticity, that the remaining cable from Santiago to Jamaica and the Haytian cable have been cut, and that Cuba is actually cut off from telegraphic communication with the rest of the world.

Miscellaneous Notes.—The war-revenue bill, as it passed the Senate, contained for stamp taxes on telegraph dispatches and a certain class of telephone messages. Each telegraph dispatch is taxed one cent, and each pay-telephone message costing 15 cents or over is also taxed one cent.

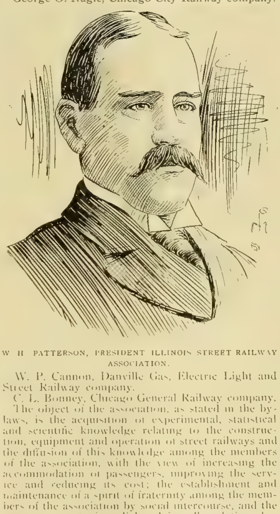
A Washington dispatch of June 9th states that General A. W. Greely, chief signal officer, has issued a general order to the cable companies directing that hereafter no news concerning the movements of American vessels or of American troops shall be sent to foreign countries. The order cover both press cablegrams and private messages.

Ensign B. R. T. Collins, formerly of the Chicago Edison company, has been assigned to the Scorpion.

Illinois Street Railway Association.

The second annual meeting of the Illinois Street Railway association was held at the Great Northern Hotel, Chicago, on June 7th and 8th. Among the representatives of street-railway companies in attendance were the following-named gentlemen:

D. A. Belden, Aurora Street Railway company.
J. F. Porter, Alton Railway and Illuminating company.
J. A. Day, Belleville Electric Railway company.
W. H. Patterson, Bloomington City Railway company.
B. F. Harris, Jr., Urbana and Champaign Electric Street Railway company.
E. X. Lesseure, Danville Gas, Electric Light and Street Railway company.
W. L. Ferguson, Decatur City Electric Railway company.
D. B. Sherwood, Elgin City Railway company.
N. B. McKinley, Joliet Railway company.
C. H. Cobb, Kankakee Electric Railway company.
W. H. Patterson, Lincoln Electric Street Railway company.
W. F. Sloan, Calumet Electric Railway company.
Walter Barker, Peoria Central Railway company.
R. N. Baylies, Rockford City Street Railway company.
J. F. Lardener, Rock Island Tri-city Street Railway company.
C. K. Minary, Springfield Consolidated Railway company.
F. O. Rusling, Waukegan Street Railway company.
W. F. Brennan, Chicago General Railway company.
E. D. DuBois, South Chicago City Railway company.
George O. Nagle, Chicago City Railway company.



W. H. PATTERSON, PRESIDENT ILLINOIS STREET RAILWAY ASSOCIATION.

W. P. Cannon, Danville Gas, Electric Light and Street Railway company.
C. L. Bonney, Chicago General Railway company.

The object of the association, as stated in the by-laws, is the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street railways and the diffusion of this knowledge among the members of the association, with the view of increasing the accommodation of passengers, improving the service and reducing its cost; the establishment and maintenance of a spirit of fraternity among the members of the association by social intercourse, and the encouragement of cordial and friendly relations between the roads and the public.

The principal business of the first day's session was the election of officers for the ensuing year. The following-named gentlemen were chosen:

President, W. H. Patterson.
Vice-president, D. B. Sherwood.
Secretary and treasurer, C. K. Minary.
Executive committee, W. H. Patterson, D. B. Sherwood, C. K. Minary, B. F. Harris, Jr., Walter Barker, W. P. Cannon, D. A. Belden.

The principal feature of the second day's meeting was the address by Charles L. Bonney, president of the Chicago General Railway company, upon the "Rights of Street Railways Under the Constitution." The speaker complained of the tendency toward municipal control of street railway companies and declared most of the schemes now advocated unconstitutional. He suggested as a means of evading municipal interference in such cities as Chicago, a resort to the federal protection:

Under present legislation new companies may be formed under the Steam Railroad Act, and as such are authorized to lease any of the old lines built under the Horse and Dummy Act, and, as such, are also authorized to convey persons and property by "animals or by any mechanical power." Such companies can then connect with other companies by lease or operating contract, can extend across county or state boundaries, and can organize an interstate and United States mail business. It is certain that as such lines extend outside of the municipal limits they become outside of the municipal control. Such companies would then pass under the jurisdiction of the state and federal railroad commissioners. These advantages are now at the exclusive option of the companies and cannot be interfered with by the municipalities. The provision of the Illinois constitution requiring the consent of the municipality is expressly limited to a "street" railway, and not a railway in the street; therefore it may not possibly apply to general railroads. If a steam railway company may operate its road with "animals or any mechanical power," why should we not prefer to become general railroads, operated by trolley, rather than "street" railways operated by trolley? Whatever the judicial distinction may be, it may worry the cities, but not the companies. We will adopt our choice, and let the other fellow do the walking.

"The Operation of Street Railways in Small Cities" was considered by E. X. Lesseure, general manager of the Danville Gas, Electric Light and Street Railway company. Care and attention to detail were essential, he said, and the best material was the cheapest. D. B. Ferguson of Decatur followed with a paper on "Tickets, Transfers and Checking Conductors."

A. E. Lang of the Toledo Traction company, president of the American Street Railway association, was present at the meeting. He spoke on the street-railway situation in Toledo, and the causes which brought it about.

The next meeting will be held at Springfield in September.

The accompanying portrait of President Patterson of Bloomington was made from a sketch drawn for the Chicago Inter-Ocean, and kindly loaned for this occasion.

Statistics of Mineral Production.

The statistics of the mineral industry of the United States, gathered with great care and thoroughness each year by Mr. R. P. Rothwell, the editor of the Engineering and Mining Journal, are very valuable. They are published at length in the successive volumes of "The Mineral Industry," that for 1897—Vol. VI.—being now in press. Advance sheets show that the mineral and metal production of the United States in 1897 was the largest in the history of this or any other country; it almost equals in value the mineral production of all Europe. The book shows that the United States is rapidly attaining the point where it will be the greatest exporter of minerals and metals of all the commercial nations. The total value of the mineral production of the United States in 1897, after making all deductions, is fixed at $678,966,644.

A comparative study of the mineral production of 1896 and 1897 reveals many interesting facts. Aluminum shows an increase of from 1,300,000 pounds to 4,000,000 pounds, the respective valuations being $520,000 and $1,400,000. The increase was due partly to the reduction in price for the metal and partly to the development of a greatly increased export trade. The increase in the production of copper was from 479,806,183 pounds in 1896 to 510,190,719 pounds in 1897, and came chiefly from the mines of Arizona and Montana. A somewhat higher price was realized, and the total value of the '97 output of copper was $56,325,055, being exceeded, among all metal products, only by iron and gold. The small production of platinum—obtained in this country as a by-product of gold refining—remained stationary. Zinc production jumped from 77,637 to 100,387 tons, and in value from $6,117,796 to $8,271,889.

Among non-metallic substances calcium carbide increased from 860 ($48,000) to 1,925 tons ($134,750). There were four works engaged in the production in 1897. A considerable part of the output was exported. The production of crystalline graphite, practically all of it from Ticonderoga, N. Y., increased from 405,006 pounds ($18,225) to 993,138 pounds ($44,691). The output of amorphous graphite, all of it from Rhode Island, increased from 574 tons ($3,850) to 1,200 tons ($11,400). The production of ground mica increased from 570 tons ($9,887) in 1896 to 2,692 tons ($38,218) in 1897. The output of sheet mica increased from 17,630 pounds ($12,528) to 92,335 pounds ($45,615). The output of both ground and sheet mica was obtained chiefly from New Hampshire and North Carolina. New Hampshire produced the most ground mica, and North Carolina the most sheet. The value of the sulphuric acid produced in the country largely increased, reaching the sum of $21,446,079 last year.

A Muskrat's Exploit.

A little muskrat caused more trouble in Buffalo the other night than is ever known to have been caused by one of the animals. This particular muskrat succeeded in cutting off the electric-light supply of nearly the entire city, and it was an hour befo e the cause of the trouble was located and removed. With the exception of an isolated district, here and there, the entire town was wrapped in total darkness. Main street was one long avenue of gloom, broken only by lights in windows by private plants. Everything had been running smoothly at the power station of the Buffalo General Electric company when the startling discovery was made that the water in the boilers and condensers was rapidly going down. An examination of the valve that lets the water in through the big feed pipe that runs out into Buffalo River was made, but the valve was open as it should be. The valves on the boilers and condensers were examined, and they were found to be all right, too. The water in the boilers dropped lower and lower, until, finally, in order to avoid an explosion, it was found necessary to bank the fires and shut off the drafts. This done, the dynamos no longer supplied current for the lamps, and the lights went out. The trouble man was called to the station. He quickly located the trouble in the feed pipe. It was cut, and, after some fishing around, he dragged a muskrat out of the pipe and dropped it on the floor.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Manager Robinson has completed the telephone exchange at St. James, Minn., giving the place local and toll-line service.

Emmett Warren, a lineman for the telephone company at Cherokee, Ia., received a severe shock while working in the office. His hand was badly burned and he was rendered unconscious for some time.

The Wayne County Telephone company held its annual meeting in Allerton, Ia., and voted to connect with the Sullivan and Porter telephone lines and give toll connection without extra charge.

The Iowa Telephone company will have new quarters in the J. W. Bopp block in West Union, Ia.

Materials are at Indianola, Ia., for the construction of the Mutual Telephone company's exchange, and work is to be begun at once.

The Standard Telephone company has begun building an exchange at Cresco, Ia.

It is believed that the Northwestern Telephone Exchange company will change its system at Little Falls, Minn., from automatic to a central office. The company offered to make the change if the subscribers could be increased to 60. The best that could be done was 54, but the indications are that the company will begin work soon to make the change.

The Wisconsin Valley Telephone company has offered to connect with the local exchange being built at Marshfield, Wis.

The Cedar Valley Telephone company will establish an exchange at Traer, Ia., and one at Dysart. Connection will be made with Elberon also.

The Iowa Telephone company has made the Anamosa, Ia., exchange a night-service office.

The Dwelle Telephone company of Lake City, Minn., has purchased a controlling interest in the Plainview Telephone company of Plainview, Minn., the change occurring June 1st. Improvements will be made to the system.

Aberdeen, S. D., is connected with Ipswich, S. D., over the lines of the Dakota Central Telephone company, the line being completed lately.

The Board of County Commissioners of Wells county, N. D., has granted the North Dakota Telephone and Electric company of Harvey, N. D., a franchise through the county.

Oshkosh, Wis., has connection with Berlin, Wis., over the lines of the Little Wolf River Telephone company, which have just been extended to Oshkosh. The new line is to be extended to Winneconne, Larson, Neenah and Menasha.

The Iowa Telephone company will install an exchange at Logan, Ia.

The Board of Public Works and the Northwestern Telephone Exchange company in St. Paul are having a difference of opinion as to whether the company ought to remove its poles from Marshall avenue, as ordered to be done by June 1st. The company asks for an extension of six months, but refuses to give a promise that the poles will be removed in that time. The board will give the company another chance to make an agreement as to the time, and if it fails to do so will recommend that the City Council have the legal department of the city proceed to compel the removal.

Judge Amidon of the United States Court has held that Lake street, in Minneapolis, and all streets over which mail is delivered, are post roads, and, as such, the Northwestern Telephone Exchange company has the right to string wires, subject alone to the police regulations of the municipality. The decision holds that every street in the United States over which mail is distributed is a post road. He also held that, if the council had, in revoking permission to set poles on Lake street, given permission to set them on a parallel street, the telephone company would have had no case. The city loses, but it can force things to an uncomfortable end for the company, for, under the decision, the wires can be ordered underground all over the city, and the company put to the expense of placing them in conduits immediately after getting them on the poles. Notice has been given in the Minneapolis Council that an ordinance requiring the wires on Lake street to be put underground will be introduced soon. The city attorney thinks that an appeal would change the decision, so far as holding every street to be a post road on which mail is distributed, but thinks that with the power to order wires underground all over the city the appeal is unnecessary.

H. G. Webster, who has been manager of the Northwestern Telephone Exchange company's office at Grand Forks, N. D., for the past five years, has been promoted to assistant superintendent of the Minneapolis exchange. He is succeeded at Grand Forks by R. G. Fahnestock, from St. Cloud, Minn.

Efforts are being made to sell stock in a telephone concern which proposes to build a line from St. Paul to Hastings, Minn.

The Iowa Telephone company has put up 15 private lines in Elkader, Iowa.

E. T. Dufur has bought the Lorimor and Macksburg, Ia., telephone line and is rebuilding it.

The Standard Telephone company has reduced rates for its service in Decorah, Ia. There are 200 instruments in use in that city.

The city of Woodbine, Ia., has granted a franchise to the Iowa Telephone company.

The Cedar Valley Telephone company has completed connections with the important lines of Tama county, Ia., including Tama City, Traer and Toledo.

The Rocky Mountain Bell Telephone company has begun extending a line from Parrott, Mont., to Dillon and Virginia City, and to Twin Bridges. A line will be built at once from Missoula to Coeur d' Alene, Idaho, and another line is in progress to Baker City, Oregon, from Boise, Idaho.

George Horn & Co. of Adell, Wis., will build a line to connect Silver Creek, Random Lake and Adell.

The Village Council of River Falls, Wis., has revoked the old franchise of the Pierce County Telephone company and granted a new one with new conditions.

The Iowa Telephone company is stringing two new wires between Muscatine, Ia., and Oskaloosa.

The Iowa Telephone company will be granted entrance to Ira, Ia.

Percy Hoyt has been appointed inspector of instruments for the Sunset Telephone company at Seattle, Wash.

The Fergus Telephone company has been incorporated at Fergus Falls, Minn., with $15,000 capital stock. G. Barrows, Robert Hannah, E. A. Jewett, W. L. Parsons, all of Fergus Falls, and W. H. Davy of Moorhead, Minn., are the incorporators.

The Mutual Telephone company of Cedar Rapids, Ia., is constructing a new cable to the West Side.

The Wisconsin Telephone company is an applicant for entrance to Chilton, Wis.

J. F. Cass, president of the Western Electric Telephone company, was in Minneapolis recently. In an interview, he said that the new telephone company would surely install an exchange in the city, and that competition was as good for telephone business as for anything else. The Minnesota Central Telephone company's long-distance lines have reached the city limits.

W. T. Sparks is installing a telephone system for Lodi, Wis.

The Minnesota Central Telephone company will soon have the local exchange for Glenwood, Minn., completed and in operation. The long-distance connection is expected to be completed soon.

The Board of Aldermen of St. Paul voted to return the $5,000 cash deposit of the Mississippi Valley Telephone company.

Telephone connection has been completed between Elbow Lake, Minn., and Herman.

The Northwestern Telephone Exchange company has appealed from the award of the commissioners allowing damages for a right-of-way between Mankato, Minn., and Lake Crystal, alleging it to be "grossly excessive."

Extensions and Improvements.

A new telephone line will be built by John N. P. Insley from Salisbury, Md., to Quantico and Nanticoke Point, connecting at White Haven with the line from Princess Anne.

The Chester County Telegraph and Telephone company is arranging to extend its line from West Chester, Pa., to Oxford, through Kennett Square, Avondale and West Grove.

The Bell Telephone company has commenced work on a new exchange in the city of Quebec. The structure will be built of granite and will cost upwards of $20,000. The switchboard will accommodate 3,000 subscribers.

Progress with the erection of poles and wires for the States telephone exchange at Guernsey, England, has so far advanced that it is expected that the exchange will be open for business this month. The switchboards are being especially made for the Guernsey exchange, and comprise several novel devices designed to save labor, facilitate rapidity in making connections and reduce the chance of error. The first circuits completed will be St. Peter-Port, St. Sampson's and the Catel, including several subscribers at Cobo. St. Andrew's and St. Martin's will be joined up a month or so later, and switchrooms at the Vale, at the Forest and St. Peter-in-the-Wood will be opened as soon as the necessary number of subscribers present themselves. When all the circuits are opened there will be between 300 and 400 subscribers, which, according to the London Electrical Engineer, is a good number for a start.

Central Energy Telephone System.

The accompanying cut illustrates the type of subscribers' telephone for the central-ringing energy and local talking-battery system of the Stromberg-Carlson Telephone Manufacturing company, Chicago.

This instrument is the same as type "Z," but with battery-box for the local battery. In this system the regular exchange equipment can be used in part. It also requires full metallic construction.

In the Stromberg-Carlson central-energy telephone system all the parts subject to deterioration and wear are placed at the central office, leaving nothing at subscribers' stations requiring attention and reducing cost of maintenance to practically nothing. It is convenient, durable, economical and is claimed to be the only system of its kind on the market. The transmitter and receiver not being effected by the greatest variations in temperature or atmospheric changes, and being locked to prevent all opening by inexperienced persons, leaves no possible cause for readjustment. They are said to be the only instruments that can be used satisfactorily in such systems.

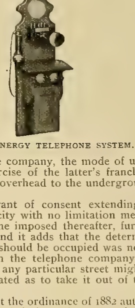
Telephone Wires in City Streets.

By an ordinance of December 24, 1879, the Bell Telephone company was "authorized to run and maintain its wires over and through the streets of the city of Philadelphia for the purpose of establishing telephonic communication between its patrons and between its exchange office and the subscribers thereto." Except certain preliminaries, which were complied with, the only condition imposed by this ordinance was that the company should enter into a written obligation to comply with all the ordinances, then existing or thereafter passed, 'regulating or in any manner controlling telegraph or telephone companies in the use of the streets for telegraph and telephone purposes."

The Bell Telephone company having accepted this obligation, and constructed its lines, the Supreme Court of Pennsylvania says that it is clear that the power of the city to impose conditions upon its grant of consent was ended. Its authority thereafter was only that of regulation as to the use of the streets.

But the grant of authority to run and maintain wires "over and through" the streets, the court holds, did not include permission to lay them under, below, or beneath. "Over" and "through," it says, are equivalent to "across" and "along," not only by the natural meaning of the words in this connection, but by the practical construction given to them at the time by the acts of the parties.

When, however, in June, 1882, the city directed the removal of all poles and wires, except its own, from the streets prior to January, 1885, and prohibited the erection of any others after that date, and the telephone company raised no question as to the reasonableness of this ordinance as a regulation of the use of the streets, but proceeded to construct and put into operation, in a considerable part of the city, its underground conduits and wires, the Supreme Court holds that, by the concurrent act of the city and the company, the mode of using the streets in the exercise of the latter's franchise was changed from the overhead to the underground system.



CENTRAL ENERGY TELEPHONE SYSTEM.

The original grant of consent extending to all the streets of the city with no limitation means that there could be none imposed thereafter, further declares the court, and it adds that the determination as to what streets should be occupied was no longer in councils, but in the telephone company, except possibly, so far as any particular street might be so exceptionably situated as to take it out of the general rule.

Moreover, in that the ordinance of 1882 authorized, and in fact commanded the replacement of the overhead by the underground system, the court holds that, in so doing, it necessarily authorized the construction of conduits, terminal poles, or any such appliances as are or may be reasonably necessary to make the system effective.

And the authority to regulate the manner of occupation of the streets, which the city retained, the court holds, included the power to compel the adoption from time to time of all reasonable and generally accepted improvements which tend to decrease the obstruction of the streets, or increase the safety or convenience of the public in their use. And the use of terminal poles being the system theretofor adopted, the court holds that the burden of showing that there was a better one in general acceptance and reasonably adoptable by the telephone company would be upon the city.

International Telephony.

The Elektrotechnische Zeitschrift says that a new metallic-circuit telephone line is about to be built between Paris and Brussels, and that the Belgian government is negotiating with the German government to secure a connection between this new line and the Brussels-Cologne and Cologne-Berlin lines. This would put Berlin and Paris in telephonic communication. If the electrical constants of the new Paris-Brussels line are to be such that speaking is possible to Berlin, it should also be possible to use it for regular service between London and Brussels via Paris, and perhaps between London and parts of Germany also. It is said, however, that the present London-Paris cables are continuously in use during the greater part of the day, so that no extensions are likely to be contemplated at present.

Death of Judge Grinnell.

Julius S. Grinnell, general counsel for the Chicago City Railway company, died suddenly in the Illinois Trust and Savings Bank, Chicago, on Wednesday, June 8th. Mr. Grinnell was attending a business conference with the bank officials on behalf of the Chicago City Railway company when he experienced an attack of heart trouble which resulted fatally almost immediately.

Judge Grinnell, as he was commonly termed, on account of the position he occupied before he became general counsel for the railway company, was an able lawyer and an experienced man of affairs, and he possessed the confidence of the community to a degree that few men command. He had a distinguished record as state's attorney and judge in Chicago before entering the service of the street-railway company, having conducted many famous criminal prosecutions successfully. Among these were the trial of the anarchists and the almost equally famous boodle and ballot-box-stuffing cases, in all of which he secured convictions of the offenders.

His record as a corporation lawyer was equally good, and he was considered an authority on the law governing street-railway properties. Personally he was of an engaging disposition and was one of the most popular officials of the street-railway company. He was ever mindful of the interests of others, and his treatment of his associates, especially young lawyers, won many friends.

Mr. Grinnell traced his ancestry through a long line of Americans, Welsh and French to the town

JULIUS S. GRINNELL.

of Grinnelle, in France, just within the fortifications of Paris. His father was Dr. J. H. Grinnell of New Haven, Vt., where Mr. Grinnell spent his boyhood. He was a graduate of Potsdam Academy, St. Lawrence county, N. Y., and of Middlebury (Vt.) College. He studied law in the office of William C. Brown of Ogdensburg.

Mr. Grinnell was married in 1869 to Miss Augusta Hitchcock, daughter of Dr. William H. Hitchcock of Shoreham, Vt. There are two children, Robert, a student at the University of Michigan, and Bertha, who is at school in Chicago.

Mr. Grinnell was a member of the Chicago, Union League, Iroquois and Chicago Athletic clubs, and of Apollo Commandery, K. T., and Consistory.

Convention News and Gossip.

[*Continued from page 345.*]

the five stations erected by his company, beginning in 1888. Lately the company has concentrated its steam generating plant in a new condensing station on the river, with single-phase and three-phase generators, operating the old plants as sub-stations and using the direct current, three wire, low-tension system of distribution, in a way very similar to the plan of the Chicago Edison company.

One of the older members of the association commented on the great change in the membership that had taken place since the last Chicago convention, that of 1889. The nine years intervening have witnessed a tremendous development in the electrical industries, accompanied by a solidifying and shaking-down process. The electric-lighting business was in the heyday of the "boom" period nine years ago, now it is approximating the stage of a well-established industry, with settled and recognized standards. Some illusions have been dispelled, and the manufacturers of electricity have a truer conception of the business in which they are engaged. There are fewer electrical enthusiasts, but many more practical electrical business men and trained engineers. The change in the method of conducting the business has brought changes in personnel and has almost revolutionized the atmosphere of the annual (then semi-annual) meetings. Comparatively few of the men active in the '89 convention were present in the gathering of this week. Those who have remained are men with the clearness of perception and the resource to adapt themselves to changing conditions.

By an interesting coincidence, the opening day of the meeting was a dark day, and this gave the first real opportunity to test the large storage battery of the Chicago Edison company in actual service. The next day was that consumed in the important debate on the relative value of alternating and direct currents for general distribution from central stations. Of course, in this discussion the use of the storage battery was bound to enter, and both the alternating and direct-current champions devoted considerable attention to it at the morning session. The latter, General Superintendent Ferguson of the Chicago Edison company, was quick to seize upon the opportunity afforded by Tuesday's experience, and when the discussion was resumed in the afternoon of Wednesday he was ready with a chart showing the load curve of the previous day. The efficient service rendered by the battery on Tuesday forenoon in taking a large share of the sudden and abnormal load, when the storm came up, was graphically shown to all present, and much weight was carried by Mr. Ferguson's declaration that the storage battery (which can be used, of course, only with direct current) was a useful auxiliary. It was a quick and enterprising bit of work, and it was effective.

Exhibitors and Visitors.

A. W. Watriss was on hand to push things for Charles A. Schieren & Co.

Richard O'Connor represented the National Carbon company of Cleveland.

Channing T. Gage represented Washburn & Moen and was constantly to the front.

George W. Conover, specialist in the Monadnock block, was "right there" all the time.

Manager Kuhlman of Elkhart, Ind., kept the Kuhlman Electric company before the delegates.

Messrs. McGill and Pomeroy were in attendance and were warmly greeted by many friends.

W. S. Hine and E. L. Barr of the Wallace Electric company were in constant attendance.

Charles G. Armstrong, the Chicago electrical engineer, mingled with the throng in the rotunda.

G. E. Varney of Varney & McOuat, electrical specialists of Indianapolis, mingled with the boys.

Manager L. H. Rogers of the Fort Wayne Lamp company stayed the full three days with the boys.

The Cutler-Hammer Manufacturing company was in evidence in the person of General Manager Cutler.

President Morgan Brooks of the Electrical Engineering company, Minneapolis, arrived Wednesday morning.

Secretary and Manager W. D. Packard of the New York and Ohio company of Warren, Ohio, was on hand.

Mr. Swingley of the Chicago Armature company was, of course, on hand, and very ably represented his company.

There was one man that was greatly missed. S. M. Hamill should have been at the convention. Why wasn't he there?

President Marsh of the Bryan-Marsh company presented the merits of his company in company with Western Manager Hill.

A. G. Zamel of the Zamel Arc Light Meter company of 266 Blue Island avenue, Chicago, mingled with the assembled delegates.

Roth Bros. & Co., Chicago, were, of course, "in it," and consequently their dynamos and motors came in for a good deal of attention.

Manager Norman Marshall of the Anchor Electric company, in company with Western Manager C. O. Baker, was on deck at all hours.

Popular George J. Jackson, the man of national reputation, was there, too, on behalf of the National Conduit and Cable company of New York.

There was never a convention that did not see the face of J. S. Crider, secretary of the Washington Carbon company, and this time was no exception.

The Triumph Electric company of Cincinnati had able representatives at the convention to remind the delegates that Triumph apparatus was still at the front.

John Child, representing A. O. Schoonmaker, is now said to be one of the "smoothest." "Child's nerve was with him," some one said, as he gazed at that piece of mica 14½ by 32 inches that hung just over the main stairway from the rotunda to the parlor.

It was a matter of great regret that General Manager J. S. Speer of the Partridge Carbon company did not appear at the convention. Where was Partridge?

K. McLennan & Co., representing Gale's commutator compound, flooded the convention with their circulars, but Manager Isaacs was among the missed.

F. A. Wunder of the Fort Wayne Electric corporation, Fort Wayne, Ind., bobbed up, bringing along with him that smile that has sold hundreds of machines.

The Swarts Metal Roofing company, Chicago, was represented by Seymour Swarts, president, who was cordially received by many of his customers at the convention.

The Auditorium Hotel management deserves great credit for the ease with which the throng was handled. Many were the words of praise for Manager Southgate.

Manager Charles Holmes, of the supply department of the Chicago Edison company, was indefatigable in his efforts in adding to the pleasure of all visiting delegates.

Secretary and Manager Edmund Dickey of the American Carbon company of Noblesville, Ind., was accompanied by A. T. Webb, appearing on Thursday at the Auditorium.

Godfrey Luthy of the Royal Electric company made the trip from Peoria in company with Electrical Engineer Scheeffer. Mr. Luthy is popular and always welcome.

General Manager Smith of the Chicago Insulated Wire company mingled with the guests in the rotunda. Mr. Smith is now a regular attendant at electric-light conventions.

J. C. Wormley seized the occasion not only to push his incandescent-lamp business, but to remind people in general that the "La Marquette" lamp is the lamp for bicycles.

Manager Hickcox of the American Rheostat company was at the Auditorium on Wednesday. Mr. Hickcox will soon make an interesting announcement to the electrical trade.

George S. Searing, the man who sells Hart switches in Chicago, was a visitor and a very popular one. Mr. Searing is gifted with a personality that makes and retains him friends.

R. E. Lucas, the genial secretary of the Indiana Rubber and Insulated Wire company of Jonesboro, Ind., was on hand. Paranite wires, manufactured by this concern, are in greater demand than ever before.

The inimitable Charles D. Shain of New York was one of the first to arrive. In fact, he appeared even before the New York delegation. Mr. Shain stayed during the convention, and met many of his Chicago friends.

A man never absent from conventions is J. R. Wiley, manager of the western sales department of the Standard Underground Cable company. Mr. Wiley was accompanied by his sisters, Mrs. Patterson and Miss Wiley.

The Northern Electrical Manufacturing company of Madison, Wis., was well represented in the person of G. A. Edward Kohler. Kohler Bros., it will be remembered, were recently appointed agents for the Northern company.

The Sawyer-Man Electric company had an interesting exhibit of incandescent lamps at the Westinghouse headquarters, and was capably represented by Messrs. F. H. Smith, manager, of Pittsburg, and C. A. Ross of Chicago.

Sears B. Condit, Jr., manager of L. A. Chase & Co., came from Boston to mingle with his many western customers. Mr. Condit is a true Bostonian, and believes in the Hub, but he has made many warm friends through his courtesy.

"Charlie" Jenney of the Jenney Electrical Manufacturing company of Indianapolis arrived on Wednesday. Mr. Jenney is rebuilding the old burnt-out Jenney factory, with every prospect before him of a most successful business.

The firm of Meysenburg & Badt was represented by F. B. Badt, O. W. Meysenburg, William Goltz and R. F. Schuchardt. It is safe to say that the convention resulted beneficially to this firm, with so efficient a staff to represent it.

General Manager James I. Ayer of the American Electric Heating corporation of Cambridgeport, Mass., was one of the first to arrive. Mr. Ayer's appearance at a convention always recalls his memorable convention at St. Louis.

Mr. Arthur Warren, who has recently assumed the management of the advertising department of the Westinghouse Electric and Manufacturing company, came early and stayed late. Mr. Warren is a courteous gentleman, whose pleasant personality adds to his recognized skill as a handler of that difficult problem, advertising. Mr. Warren has this exten- [illegible]

department entirely in his charge, and his work stamps him as one of the foremost electrical advertising men in the United States.

The Varley Duplex Magnet company was, is usual, skillfully represented by Mr. Knox. Mr. Knox is now located in the office of the Central Electric company, looking carefully after this branch of that large institution's prosperous business.

Mr. M. B. Austin of M. B. Austin & Co. was on hand with that smile that has done so much for Safety insulated wire, especially in the West. Mr. Austin has recently taken in a partner to share the glory of a rapidly growing business.

Popular Colonel Shay did the honors for the Charles Munson Belting company. Colonel Shay has a quiet way of insinuating himself into the affections of electric-light men, and it is said on this occasion he "booked" quite a number.

S. F. B. Morse was, of course, on hand, for what would a convention be without Morse? Mrs. Morse was also one of the coaching party of Tuesday and joined with the other Chicago ladies in extending greetings to the ladies from out of town.

Where was Charlie Newton of the Eddy company? Baird was there, and somebody said this latter gentleman was disconsolate for his "better half." Mr. Newton has been a constant attendant at all conventions, and he must never make excuse again.

The genial secretary of the Phillips Insulated Wire company, Henry C. Adams, Jr., of Pawtucket, R. I., was on hand too. Mr. Adams had no exhibit, but his unfailing courtesy was of as much benefit as an exhibit of cold facts would have been.

The Electric Appliance company was in full feather, as is evidenced by the following list of representatives, who did the honors: Thomas I. Stacey, W. W. Low, Messrs. Millard, Towner, C. J. Wells, B. B. Downes, Perry Boole and William Stacey.

The Fort Wayne Electric corporation was represented by Messrs. Charles Munson of the Chicago office, C. E. Wilson of Philadelphia, Kirkpatrick of Grand Rapids, R. E. Stearns of New Orleans, Willard Knight, Geiger and Frank A. Wunder of New York.

President John C. Boss of the Lakon company, the well-known manufacturer of transformers at Elkhart, Ind., was one of the most popular men in attendance. Mr. Boss is one of the leading men of Elkhart and has a host of friends. Mr. Boss was accompanied by G. Mahony.

General Manager T. S. Lane of the Electrical Exchange, in company with H. H. Hornsby, did the honors for the Electrical Exchange. The Electrical Exchange has made a host of friends, and many are the kind remarks heard relative to Mr. Lane's enterprise and "hustling" proclivities.

One of the most popular of the supply representatives at the convention was Western Manager J. C. Shainwald of P. & B. paint fame. There were many inquiries for Mr. DeRonde, who has, indeed, "gone to the war." He was very much missed, as DeRonde and Shainwald make a pair hard to beat.

George Whyte of the Leschen-Macomber-Whyte company distributed a neat little booklet. Mr. Whyte was accompanied at the Monday night reception by Mrs. Whyte. It is safe to say that no two people will be more welcome at coming conventions than Mr. and Mrs. George Whyte.

Bernard Hartley, manager of the Hartley Electrical works, Chicago, was on hand during the convention and took advantage of the opportunity to renew old acquaintances. Mr. Hartley is an old Westinghouse man, and besides securing a number of orders, spent a pleasant time with many of his old associates.

Col. G. A. Hurd did the honors for the Crane company, Chicago. Colonel Hurd is now actively engaged in patriotic work in the organization of Hurd's Volunteer Regiment. Mr. Hurd is an old military man, and his fighting qualities show not only in his military work, but in his business as well.

Irving Rouse Prentiss, to give him all the names he is entitled to, of the General Electric company's lighting department at Philadelphia, was, as usual, everywhere, and did most excellent work for his company. Mr Prentiss is an old Brush man and one of the best posted arc-light salesman in the business.

The Garton-Daniel Electric company was one of the three companies whose interests were looked after by Mr. W. R. Garton. This company's lightning arrester has now become one of the standards, and its success is well deserved as it is said to be one of the most efficient devices of this kind on the market.

The Jandus Electric company of Cleveland, O., had the merit of its good ... represented through the attractive personalities of J. H. Cooke, western manager, and H. T. Edgar, manager for New England. Messrs. Cooke and Edgar were everywhere and at all times. The Jandus company had a telling card in the remarkable small consumption of carbon of the company's new lamp. Twenty-five carbons a year is all that this lamp requires, and when it is considered that the estimated cost of these is only 75 cents, it will be realized that Messrs. Cooke and Edgar had plenty to do. Mr. Cooke also looked after the interests of the Buckeye Electric company of Cleveland.

President W. N. Matthews of the St. Louis Electrical Supply company, St. Louis, arrived at the Auditorium on Wednesday morning. It was a matter of regret that Mr. Matthews could not have arrived sooner in order to have attended the reception and also to have done the honors for St. Louis in the coaching party.

H. J. Gille of St. Paul, Minn., formerly with the General Electric company, and recently with Washburn & Moen, was congratulated by his many friends on his recent appointment as general sperintendent of the electrical departments of the St. Paul Gas Light company and the Edison Electric Light and Power company.

The Crocker-Wheeler Electric company of New York made no exhibit, but was kept well to the front through the efforts of Western Manager C. H. Wilmerding, assisted by Julian Roe. Mr. Wilmerding earned the hearty thanks of the ladies at the reception on Monday night by his successful effort to make them all have a good time.

Secretary and Treasurer W. D. Hughes of the Central Manufacturing company of Chattanooga, Tenn., arrived in Chicago on Thursday, just in time to "be in at the death." Mr. Hughes is doing a prosperous business in electrical lumber, and Chattanooga, through him, is now looked upon as one of the centers for this branch of the business.

President and General Manager Henry B. Cutter of the Cutter Electrical and Manufacturing company, accompanied by Mrs. Cutter, was among the first to arrive, coming with the New York delegation. Mr. Cutter is one of the most constant attendants at conventions, and Mrs. Cutter this time made a most agreeable addition to the ladies' contingent.

Capt. Willard Candee and George T. Manson, as has been their time-honored custom for years, told the "old, old story" of Okonite. These gentlemen distributed among the warmest friends of Okonite a souvenir in the shape of a miniature of a beautiful girl, that may safely be said to be one of the handsomest, if not the handsomest, of the convention gifts.

"Val" and Clark were, of course, on hand, and took care of those pole men who were unwary enough to allow them to approach. Clark vowed and declared he had reformed, and would not attend conventions any more, but Thursday morning found him there bright and early. Valentine came, too, for it was said he could not be kept home except by a death in the family.

The American Electric Telephone company was not forgotten. Mr. P. C. Burns of the company did not lose this opportunity to "mix" with his host of old friends in the electric-light business. Mr. Burns, it will be remembered, was at one time one of St. Louis' most prominent supply men, and this opportunity proved a very pleasant one for him to renew old acquaintances.

J. Holt Gates, assisted by G. B. Foster and C. H. Philbrook, did the honors, and did them well, for the Walker company. Mr. Gates has during the last year built up a most flourishing business, and the fact that, in addition to his own time, his enterprise requires the services of two such active men as Messrs. Foster and Philbrook, speaks well for his popularity and enterprise.

J. W. Hull represented the Cabinet Manufacturing company of Steubenville, O. Mr. Hull has been actively engaged for some time pushing the business of his company, especially among the telephone manufacturers in the United States. His success has been remarkable, as is shown by his factory's present crowded condition. Mr. Hull is a man whose personality makes him a host of friends.

Manager Charles E. Coleman of Eugene Munsell & Co. and the Mica Insulator company, Chicago, appeared at the convention early Tuesday morning. Mr. Coleman had lots to do, as he is one of the most popular and hustling salesmen in his line in the West. Under his management his two companies' businesses have increased at a remarkable rate, and there is no one more deserving of success than Coleman.

President A. M. Searles and Electrical Engineer G. A. Scheeffer of the Diamond Electric company did most excellent work through the exhibition of their well-known Scheener meter. This device stood in a corner of the rotunda, and its careful and accurate workmanship were much admired. Mr Searles, one of the most experienced men in the electrical business, had his time fully occupied in meeting his friends.

Thomas R. Mercein of the Northwestern Electrical association came early and stayed late, and several new members were added to the already large list of the Northwestern Electrical association. The silver-tongued orator was on hand on every occasion, and he did splendid work on behalf of the association that is proud to call him secretary. Mr. Mercein's work at the National convention, however, was only the beginning, for he came prepared to look after the interests of his association on the trip to Duluth.

General Manager H. H. Brooks of the American Circular Loom company, assisted by the general western agent, George W. Patterson, did great work for his popular conduit. Mr. Brooks was warmly welcomed by a host of friends who were glad to see him after his long western trip. His souvenir, in the shape of a smoking outfit, was much sought after; in fact, it is said, that he had to hide a few for his best friends.

The ubiquitous Colonel S. G. Booker of the Phœnix Carbon Manufacturing company of St. Louis, was on hand during the entire time. Colonel Booker isan enterprising carbon man, who never lets the grass grow beneath his feet. His carbons have a national reputation, and his aggressive and enterprising methods have increased his company's business to such a point that an extension to his factory has been necessary.

President Schumacher of the Zamel Arc Light Meter company, Chicago, came nearly losing his reputation as one of the best of good fellows, by not turning up until late Wednesday afternoon, but he got there just the same. Mr. Schumacher has made a great success with the Zamel arc-light meter. This device records the number of hours of service of arc lamps, and is well worth the investigation of central-station men interested in economy.

George Cutter of the George Cutter company and his right-hand man, Albert Scheible, two "electrical specialists," were on hand accompanied by the usual supply of Cutter's "devils." Mr. Cutter is now pushing the business for which, so to speak, he is eminently designed, that is, the production of novel and useful electrical specialties, and his establishment at 100 Lake street, Chicago, places him in a position to carry out his heart's desire.

The Central Electric company, Chicago, was represented by President George A. McKinlock and Secretary C. E. Brown, to say nothing of Messrs. Burton, Upham and Cobb. The Central company made no exhibit, but its full force of indefatigable workers was on hand at all times at the Auditorium. Messrs. McKinlock and Brown attended the reception Monday night. The souvenir ash-tray distributed by the Central company was highly prized.

The Eddy Electric Manfacturing company was represented in the person of M. E. Baird. Mr. Baird was one of the first to come and the last to leave, and warmly was he welcomed. The business of the Eddy company has increased most rapidly during the last year, and the rapid progress made is due largely to Mr. Baird's indefatigable work. Mr. Baird is a hustler, and leaves no stone unturned in keeping Eddy machinery in the very front rank.

Until the last moment it was expected that Joseph Franklin and Manager of Sales Paul D. Cable would come up from St. Louis to do the honors for the Commercial Electrical Supply company. Some one whispered, however, that the large fan business they were doing in St. Louis prevented them from turning their faces northward. It was a matter of great regret that these two men could not have found the time to appear. They would have been warmly welcomed.

The Electric Storage Battery company appeared in the persons of Herbert Lloyd, Frank H. Clark, John P. Williams and Joseph Appleton. This company did not make an exhibit at the hotel, although it had a parlor at the Auditorium, where hospitality was dispensed. The Edison storage battery, however, was in reality an exhibit, and it attracted an immense amount of attention, due to the fact that it is one of the most remarkable exhibits of its kind in this country.

Manager G. O. Rockwood of the Rockwood Manufacturing company, Indianapolis, Ind., made a most interesting exhibit in one corner of the rotunda. Mr. Rockwood showed a device through which it was proved, by practical demonstration, that the Rockwood paper pulley had a much greater adhesion for a belt than a common iron pulley. It was noticed that the Japanese gentlemen who attended the convention were particularly interested in this device.

President Frank N. Phillips of the American Electrical Works, Providence, was in constant attendance, in company with Western Manager Frank Donohoe. It is not often that Mr. Phillips goes as far West as Chicago, and Mr. Donohoe royally did the honors. In fact, there is never a convention that Mr. Donohoe does not add to his laurels in this respect. Edgar H. Hammond, also of the western office of the American Electrical Works, joined forces with Mr. Donohoe during the last days of the convention.

President Frank E. Healy, Secretary Lemuel K. Cushing and Manager Carl Keith made their first appearance at a convention in the representation of the prosperous new Chicago electrical supply house, the Illinois Electric company. These men are of experience in the supply business, and thus far, from all reports, their venture has proved successful beyond their fondest expectations. This was to be expected, however, with young men of such

capabilities as these three members of the company are known to possess.

W. P. Sullivan of the Menominee Electrical and Mechanical company of Menominee did himself proud. In fact, it was said on all sides that the coaching party would not have been a success had not Mr. Sullivan held the reins of the leading coach, so to speak. Mr. Sullivan has represented the Menominee company for nearly a year, and through his large number of western friends has been able to greatly increase this concern's business. Mr. Sullivan is well liked, and this fact undoubtedly adds greatly to his business success.

General Manager Gilmer of the Warren Electric Specialty company, Warren, O., appeared on Wednesday. Mr. Gilmer is a peaceable-looking man, and one would hardly expect to find behind that genial and courteous bearing so much of the sternness that has brought his company so far to the front in its fight against the "lamp trust." Mr. Gilmer is now seeking a good name for his lamp. He believes it is rather to be chosen than great riches. In fact, his company is now offering a prize for a new name for his new lamp.

President J. B. Crouse of the Crouse-Tremaine Carbon company, also president of the Fostoria Incandescent Lamp company, was on hand during the convention. Mr. Crouse reports much success with his new Fostoria Lamp company, and also that his two institutions have recently appointed a Chicago representative in the person of J. W. Brooks. Mr. Brooks, until recently, was president of the Brooks-Follis Electric corporation of San Francisco. He will hereafter make Chicago his headquarters and attend to the interests of the two Fostoria companies.

Manager R. D. Allen, accompanied by the district sales agent, W. L. Arnold, was on hand taking care of the affairs of the Siemens & Halske company of America. Mr. Allen has recently taken charge of the Siemens & Halske affairs, and the company is already feeling the effects of his aggressive and progressive policy. Mr. Arnold has only recently joined forces with the Siemens & Halske company, and it may be said that the addition will redound to the credit of the company's present aggressive policy. Mr. Arnold is one of the best known electric-light salesman in the country.

Secretary-treasurer and Manager R. H. Bouslog of the Peru Electric Manufacturing company, Peru, Ind., could not forbear to avail himself of the pleasant opportunity to meet in a social manner the many friends of the Peru company. Mr. Bouslog has recently gotten out a catalogue describing a number of novel electrical specialties and calls particular attention to the Peru patent fuse plug. This is a porcelain device that will undoubtedly have a large sale. In fact, there are a number of interesting specialties that will make this catalogue valuable to every man purchasing porcelain supplies.

To again refer to James Wolff of the New York Insulated Wire company as a prince of good fellows would be a well-worn repetition, but it seems necessary to use the familiar phrase. There is no doubt that Wolff of the New York Insulated Wire company and George Whyte of the Leschen-Macomber-Whyte company are two of the bright shining lights of electrical gatherings. It would take a book, though, to tell of their achievements, especially if coupled with the list of new friends. It is a matter of great regret that these two gentlemen were unable to attend the convention of the Northwestern Electrical association.

R. J. Randolph, the general manager of the sales department of the Sterling Arc Lamp company of New York, managed to secure for his company a most conspicuous and striking display parlor. What Mr. Randolph exhibited had the quality of delighting the eye as well as the palate. The Sterling enclosed arc lamp was decidedly on hand. The Sterling constant-potential, 110-volt lamp was shown, as was also a series $6\frac{1}{2}$ ampere, 65-volt lamp, and a series $9\frac{1}{2}$-ampere, 65 volt Sterling lamp. Mr. Randolph is one of those genial entertainers who manages, so to speak, to present a bouquet to every prospective customer, and in this case he excelled himself.

A. W. Morrell, who has met with such success in the institution of an electrical department for the Miller-Knoblock company of South Bend, Ind., seized the opportunity to run up and mingle with the delegates. Mr Morrell is what might be termed a commutator specialist, and the Morrell commutator made by his improved hydraulic process is a marvel of accurate and solid work. Those interested in commutators and the prevention of their troubles should correspond with Mr. Morrell, especially those who have Western Electric machines and are desirous of learning something about what Mr. Morrell claims as a most decided improvement on the standard type of commutator usually employed on that type of machine.

James F Cummings, now perhaps better known as the "conduit king," was on hand and did much missionary work in announcing the appearance of a new Cummings tubing Mr Cummings has recently organized the Cummings Electric Tube company of Detroit, and is now preparing to take contracts for the delivery of high tension currents underground through the agency of his new tubing Mr Cummings claims that the new Cummings tube is cheaper than lead covered cables The specialty is well worth the investigation of those considering the installation of high-tension electrical machinery. Mr. Cummings also represented at the convention the Armorite Interior Conduit company of Pittsburg and also the Cummings Conduit company of Detroit.

The Raster Carbon Rheostat company and the W. R. Garton company, Chicago, appeared in the persons of W. R. Garton and Ray P. Lee. Mr. Garton and Mr. Lee have recently formed the W. R. Garton company, and a few months ago Mr. Garton assumed the position of consulting engineer for the Raster Carbon Rheosat company, and in this capacity he represented the Raster company and explained the merits of the Raster Carbon rheostat. This device is a decided novelty, in that it is claimed for it that it is the only successful carbon rheostat, and that whether the resistance be hot or cold, it remains constant. Those interested in the carbons of the Raster company will do well to send for the company's new circular, which explains in detail the merits of this interesting device.

Vice-president and General Manager Robert F. Carr and C. M. Eddy, in the absence of President Edgar, kept the Dearborn Drug and Chemical Works of Chicago most prominently to the front. It had been hoped that Mr. Edgar would return from his trip in time to take advantage of not only the National convention but the Northwestern convention as well, but he was unable to make it. But Messrs. Carr and Eddy told the story of the company's many "patients." As it is now pretty generally known, through the company's extensive advertising, the Dearborn company is handling the problem of boiler cleansing in a most thorough and scientific manner. It is apparently a case of making the punishment fit the crime and the medicine fit the sickness. In a word, the Dearborn Drug and Chemical Works prescribes a compound to suit and cure every case of boiler disease.

The Columbia Incandescent Lamp company of St. Louis was well represented through A. C. Garrison, Chicago Manager George P. Rex and Guy V. Williams. The company made no exhibit. Mr. Garrison was unable to reach Chicago until Wednesday morning, and, owing to his father's sudden illness, was unable to remain to attend the Northwestern gathering at Duluth. Messrs. Rex and Williams were appointed to carry out this portion of the programme. Since Mr. Rhotehamel's sudden death Mr. Garrison has been nearly overwhelmed with work, but he has well withstood the strain. In fact he has carried the entire load and responsibility of the business, and it may be said to his great credit that not only has the company prospered, but it has done better under his management than at any previous like period. Mr. Garrison is now one of the convention "regulars," and it was a matter of great regret that he could not continue to Duluth.

The Westinghouse Electric and Manufacturing company, with headquarters at 104 and 106 Auditorim, was ably represented by F. H. Taylor, general sales manager; Arthur Warren and A. S. Morris of Pittsburg, and by Maurice Coster, Chicago sales manager; Henry Floy, W. S. Rugg, C. W. Regester and T. J. McGill of Chicago. The company's headquarters were tastefully decorated in the national and Cuban colors. It also exhibited a few well-selected pictures, showing the details of its various manufactures and views of the shops. All the above-mentioned gentlemen are well known to the electrical trade, and on account of their popularity the Westinghouse quarters were thronged with guests, who were greatly pleased with the arrangements which had been made for their comfort. A neat effect was exhibited in the form of a shield with the company's motto, "The name Westinghouse is a guarantee," engraved thereon, which is true of its hospitality as well as its high-grade apparatus.

The Wagner Electric Manufacturing company of St. Louis was represented in the convention by the following-named gentlemen: Mr. E. H. Abadie, manager of sales; Messrs. S. E. Johannesen and E. S. Pillsbury of the engineering staff, and Mr. W. A. Layman, assistant manager. Their suite of rooms at the Auditorium was attractively arranged, with quite a display of designs of their latest apparatus in switchboards, transformers, motors, etc. The only actual apparatus shown was a model set of indicating switchboard instruments of the illuminated dial "dead-beat" type. The reception hours were between convention sessions, and all visitors were royally entertained The company distributed as a souvenir of the convention a unique button, the central feature of which was the Wagner company's transformer enfolded in the American and Cuban flags. A significant motto, "In tests we trust," was also conspicuous. Mr. H. A. Wagner came as the official representative of the Missouri-Edison Electric company, and was also a representative of the Wagner company.

The Sprague Electric company was strongly represented by Vice-president and General Manager Edward H. Johnson, General Agent Charles A. Benton and Western Agent E. B. Kittle. Through the courtesy of President Carter of the Alley "L" an invitation was extended to members of the convention to make a trip over the line in a new and special train equipped with the Sprague multiple-unit system This occurred on Tuesday night, and remarkable time was made, the train stopping at all stations The Sprague Electric company, as is now well known, is making an aggressive campaign, with the idea of increasing its already very large western business. As is also well known, Mr. Kittle has recently taken charge as western manager, and he is doing excellent work. He secured the choicest place in the Auditorium as a stand for the inspection of the new Lundell "hot and cold wave" fan. This specialty is one that will be shortly described in detail by the company. This new Lundell fan delivers a hot and cold wave, as desired. In fact, it is something of an electrical curiosity, and will prove of decided interest to every supply house, as through its use one can secure a current of hot or cold air, as desired, by the simple movement of a switch.

The clubroom No. 4 of the Auditorium Hotel, was beautifully decorated with the stars and stripes. This was the temporary home of the Western Electric company during the session of the National Electric Light association, and the members and guests found a ready welcome awaiting their visits to this cosy retreat. The company made no attempt at an exhibit, but the Western Electric fan motors distributed around the room made the temperature agreeable, and Sunbeam incandescent lamps and Midget arc lamps made the room brilliant. Literature describing the various makes of dynamos, electric-light switchboards, arc lamps, fan motors, etc., was freely distributed. Placed around the hotel in advantageous positions, the Western Electric fan motors assisted in keeping the delegates comfortable and proclaimed Cuba Libre. One of the graceful acts thoroughly appreciated by those attending the meetings was the furnishing of a large number of Japanese hand fans by this company. The gentlemen representing the company and in attendance at the headquarters were General Manager C. D. Crandall, Col. George L. Beetle and Messrs. A. L. Tucker, John Ebert, E. W. Goldschmidt, C. D. Wilkinson, Julian Jackson, J. M. Hollister, L. K. Comstock and Thomas G. Grier. The factory of the Western Electric was thrown open to the visitors, and a number availed themselves of the opportunity of making a tour of inspection.

The General Electric company was represented at the convention by the entire selling staff of its Chicago office and several representatives from the other sales offices. It made no exhibit, but parties of delegates were made up for the purpose of visiting the different great stations in Chicago equipped with the latest types of General Electric apparatus. By the kindness of President Insull of the Chicago Edison company and Mr. W. E. Baker of the Metropolitan West Side Elevated Railroad company the stations of both these companies were thrown open to these parties. Mr. Insull's sub-station system attracted much attention. A large delegation also accepted Mr. B. E. Sunny's invitation to visit the large storehouse and repair shop which the General Electric company has established in Chicago for the purpose of facilitating its relations with the customers in the great territory covered by the Chicago office. The General Electric company made its headquarters at the Auditorium Hotel in room 140, which was tastefully decorated with palms and ferns. A supply of illustrated literature was also provided for those interested. The interests of the company were cared for by the following-named gentlemen: Chicago office, B. E. Sunny, F. N. Boyer, Theo. P. Bailey, J. Scribner, W. S. Arnold, W. J. Ferris, G. J. Cadwell, J. W. Buell, J. W. Johnson, E. C. Noe, O. E. Turner, A. J. Gifford, G. H. Atkin, H. T. Windsor, S. F. Dibble, W. H. Colman, J. J. O'Brien; Minneapolis office, P. A. Clisdell; St. Louis office, George D. Rosenthal; Detroit office, J. H. Livsey; Cincinnati office, W. F. Hays, W J. Hanley; Philadelphia office, I. R. Prentiss; Boston office, F. M. Kimball; Syracuse office, H. H. Crowell; Schenectady works, W. S. Andrews, Lynn works, J. Dalzell; Harrison works, A. D. Page

The Attendance.

Owing to the number of visitors who did not register, the exact number of members and visitors at the convention is not known. It was probably about 400. A group picture of a small portion of the number of gentlemen in attendance, taken on the grand staircase of the Auditorium Hotel, is given on page 340 The following list contains many names not on the secretary's book, but it is still incomplete.

Abadie, E. H., Wagner Electric Manufacturing company .... St. Louis.
Abbott, John Jay, Chicago Edison company.... Chicago.
Abbott, W. L., Chicago Edison company...... Chicago
Adams, Henry C., Jr., Phillips Insulated Wire company .... Pawtucket, R. I
Allen, R. D., Siemens & Halske Electric company .... Chicago
Anderson, H S., United Electric Light company.. .... Springfield, Mass
Andres, J Frank, Belleville Gas Light and Power company .... Belleville, Ill
Andrews, W. S., General Electric company .... Schenectady, N Y
Anthony, W. M., Chicago Edison company .. Chicago
Appleton, J., Electric Storage Battery company .... Philadelphia
Armstrong, C. G .... Chicago
Armstrong, E. A., Camden Lighting and Heating company .... Camden, N J
Armstrong, F. C., Dick, Kerr & Co .London, England
Arnold, W. L., Siemens & Halske Electric company .... Chicago
Atkin, G. H., General Electric company Chicago
Atkinson, H M., Georgia Electric Light company .... Atlanta Ga.
Atkinson, J. M., J M Atkinson & Co. Chicago
Austin, M. R., Safety Insulated Wire and Cable company .... Chicago
Ayer, James I., American Electric Heating corporation .... Boston

Babbitt, H. D., Chicago Edison company.......Chicago.
Badger, F. H., Jr., Montmorency Electric Power company.......Quebec, Canada.
Badt, F. B., Meysenburg & Badt.......Chicago.
Baird, M. E., Eddy Electric Manufacturing company.......Windsor, Conn.
Baker, C. O., Anchor Electric company.......Chicago.
Baker, C. O., Jr., Baker & Co.......New York.
Barker, F. E., Massachusetts Gas and Electric Light Commission.......Boston
Barr, Edward L., W. R. Brixey.......Chicago.
Barron, A. M., Home Electric Light and Power company.......Elkhart, Ind.
Bean, W. Worth, Jr., St. Joseph and Benton Harbor Electric Railway and Light company.......St. Joseph, Mich.
Beetle, George L., Western Electric company..Chicago.
Bement, A., Bement & Co.......Chicago.
Benton, C. A., Sprague Electric company....New York.
Billings, Miss H.......New York.
Blum, A. J., American Carbon company....Fremont, O.
Boettcher, C., Imperial Electric Light company.......St. Louis.
Booker, S. G., Phœnix Carbon Manufacturing company.......St. Louis.
Bowen, G. S.......Elgin, Ill.
Boyer, F. N., General Electric company.......Chicago.
Bradley, J. M., Birmingham Consolidated Electric company.......Birmingham, Ala.
Brinckman, E. S., Imperial Electric Light company.......St. Louis.
Brooke, W. M., Electric Appliance company.......New Orleans, La.
Brooks, F. A., Charleston T.-H. Electric company.......Charleston.
Brooks, H. H., American Circular Loom company.......Boston.
Brooks, J. W., Brooks-Follis Electrical corporation.......San Francisco.
Brown, C. E., Central Electric company.......Chicago.
Buckley, W. J.......Chicago.
Burleigh, J. J., and wife, Atlantic Electric Light and Power company.......Camden, N. J.
Burns, P. C., American Electric Telephone company.......Chicago.
Burton, C. G., Central Electric company......Chicago.
Butler, W. W. S., Milton Electric Light and Power company.......Milton, Pa.

Candee, Willard L., Okonite company.......New York.
Carlton, W. G., Chicago Edison company.....Chicago.
Carnes, S. T., Memphis Light and Power company.......Memphis, Tenn.
Carr, R. F., Dearborn Drug and Chemical Works.Chicago.
Cate, George W., Edison Illuminating company.......Detroit, Mich.
Channon, H. O.......Quincy, Ill.
Cheney, H., Chicago Edison company.......Chicago.
Child, John.......Chicago.
Childs, Charles T., American Electrician....New York.
Church, J. V. S., Electrical World.......Chicago.
Church, W. L.......Milwaukee.
Clark, E. W.......Evanston, Ill.
Clark, Frank H., Electric Storage Battery company.......Chicago
Clisdell, Percy A., General Electric company.......Minneapolis, Minn.
Coggshall, H. F., Fitchburg Gas and Electric Light company.......Fitchburg, Mass.
Coleman, Charles E., Eugene Munsell & Co....Chicago.
Collins, L. W., Leecol Storage Battery company.Chicago.
Collins, W. F., Western Electrician.......Chicago.
Comstock, C. G., Smith-Hill Elevator company.......Quincy, Ill.
Comstock, L. K., Western Electric company....Chicago.
Condit, Sears B., L. A. Chase & Co.......Boston.
Connor, J. F.......Chicago.
Conover, George W.......Chicago.
Cooke, J. H., Buckeye Electric company.......Chicago.
Cooper, Thomas, Pekin Electric Light and Power company.......Pekin, Ill.
Copeland, F. A., Edison Light and Power company.......La Crosse, Wis.
Coster, Maurice, Westinghouse Electric and Manufacturing company.......Chicago.
Crandall, C. D., Western Electric company....Chicago.
Cravath, J. R.......Chicago.
Crawford, Ronald, Stamford Gas and Electric company.......Stamford, Conn.
Creden, T. H., Chicago Edison company.......Chicago.
Crider, J. S., Washington Carbon company.......Pittsburg, Pa.
Crossman, T. E., official stenographer......New York.
Crouse, J. B., Crouse-Tremaine Carbon company.......Fostoria, O.
Crowell, H. H., General Electric company.......Syracuse, N. Y.
Culver, J. H., Culver Electric company....Decatur, Ill.
Cummings, James F., Armorite Interior Conduit company.......Pittsburg, Pa.
Cunningham, J. W., Capital Electric Light, Motor and Gas company.......Boise, Idaho.
Cushing, L. K., Illinois Electric company......Chicago.
Cutler, Harry H., Cutler-Hammer Manufacturing company.......Chicago.
Cutter, George.......Chicago.
facturing company.......Pittsburg, Pa
Cutter, Henry B., and wife, Cutter Electrical and Manufacturing company.......Philadelphia.

Daggett, R. B., Electric Storage Battery company.......Chicago.
Dale, John H., Dale company.......New York.
Daniels, A. L., the H. B. Camp company.North East, Pa.
Davis, Ernest H., Lycoming Electric company.......Williamsport, Pa.
De Camp, A. J., Brush Electric Light company.......Philadelphia.
Dee, A. V.......Philadelphia.
Dee, James R., Peninsula Electric Light and Power company.......Houghton, Mich.
De Land, Fred, Electrical Engineering.......Chicago
Dibble, S. F., General Electric company.......Chicago.
Dickey, Edmund, American Carbon company.......Noblesville, Ind.
Doan, J. P., Jacksonville Gas Light and Coke company.......Jacksonville, Ill.
Doherty, H. L., Madison Gas and Electric company.......Madison, Wis.
Donohoe, F. E., American Electrical Works...Chicago.
Dow, Alex, Mutual Electric Light company.......Detroit, Mich.
Downes, L. W., D. & W. Fuse company.......Providence, R. I.
Downs, B. B., Electric Appliance company.Minneapolis.
Drake, C. F., Fort Scott Electric Light and Power company.......Fort Scott, Kan.
Dull, P.......Milledgeville, Ill.
Dysterud, E., Electric Light company...Monterey, Mex

Ebert, J. W., Western Electric company.......Chicago.
Eddy, Charles M., Dearborn Drug and Chemical Works.......Chicago.
Edgar, H. T., Jandus Electric company.......Boston.
Einstein, A. C.......St. Louis.
Ely, J. H., Georgia Electric Light company.Atlanta, Ga.
Engel, W. T., Charlotte Electric company.......Charlotte, N. C.

Fakes, J. G.......Oklahoma City, O. T.
Ferguson, Louis A., Chicago Edison company.Chicago.
Ferguson, James, Municipal Electric Light company.......Brooklyn, N. Y.
Ferris, Thomas, General Electric company.......Milwaukee, Wis.
Ferris, W. J., General Electric company.......Chicago.
Field, C. J., Port Jervis Electric Railway and Light company.......New York.
Field, A. W., Columbus Edison Electric company.......Columbus, O.
Finney, W. E., Chicago Edison company.......Chicago.
Floy, Henry, Westinghouse Electric and Manufacturing company.......Minneapolis, Minn.
Forbrich, C. W., Western Electrician.......Chicago.
Foster, George B., Walker company.......Chicago.
Francis, Robert W., Chicago Edison company..Chicago.
Frank, Jacob, Cosmopolitan Electric company..Chicago.
Frank, S. S., Western Electric company.......Chicago
Fraser, R. H., Des Moines Edison Light company.......Des Moines, Ia.
Frith, Harry J., Watseka Electric Light company.......Watseka, Ill.
Fujioka, I., Japan Electric Light association.......Tokyo, Japan.

Gage, Channing T., Washburn & Moen Manufacturing company.......St. Paul, Minn.
Gardner, J. W., Stirling company.......Chicago.
Garrison, A. C., Columbia Incandescent Lamp company.......St. Louis.
Garton, W. R.......Chicago.
Gates, J. Holt, Walker company.......Chicago.
Gilbert, L. H., Jonesville Electric Light and Power company.......Jonesville, Mich.
Gilchrist, J. F., Chicago Edison company......Chicago.
Gille, H. J., Edison Electric Light and Power company.......St. Paul, Minn.
Gillmer, Elmer W. Warren Electric and Specialty company.......Warren, O.
Goehst, J. H., Chicago Edison company.......Chicago.
Goldborough, W. E., professor in Purdue University.......Lafayette, Ind.
Goldschmidt, E. W., Western Electric company.Chicago.
Goodhue, Wells.......Chicago.
Gordon, Thomas S.......Chicago.
Greenwood, C. H., Edison Light and Power company.......La Crosse, Wis.
Gregory, Charles E.......Chicago.
Gregory, John M., City electric light...Bellefontaine, O.
Grier, Edward R., Bryant Electric company...Chicago.
Grier, Thomas G., Western Electric company..Chicago.

Habirshaw, Dr. William, India Rubber and Gutta Percha Insulation company.......New York.
Hagar, Edward M., Southwark Foundry and Machine company.......Chicago.
Hammond, Edgar H., American Electrical Works.......Chicago.
Hanley, W. J., General Electric company..Cincinnati, O.
Hapeman, Douglas, Thomas Electric Light and Power company.......Ottawa, Ill.
Harding, C. Knox.......Chicago.
Harrington, Walter E., and wife, Camden and Suburban Railway company.......Camden, N. J.
Harris, B. F., Jr., Urbana and Champaign Railway, Gas and Electric company.......Champaign, Ill.
Hart, F. D., Jr., Pineville Electric Light company.......Pineville, Ky.
Harter, Gus.......Chicago.
Hayes, Scott.......Cleveland, O.
Hays, W. P., General Electric company..Cincinnati, O.
Healy, Frank E., Illinois Electric company....Chicago.
Hine, William S., Stanley Electric Manufacturing company.......Chicago.
Hirota, Seuchi, Takata & Co.......Tokyo, Japan.
Hixson, H. R., Simplex Electrical company....Chicago.
Holcomb, Eugene, Holcomb & Green Electric company.......Springfield, Ill.
Hold, W. F., Chicago General Fixture company.Chicago.
Holl, Thomas, Smith-Hill Elevator company..Quincy, Ill.
Hollister, J. M., Western Electric company....Chicago.
Holmes, Charles, Chicago Edison company......Chicago.
Hood, William.......Chicago.
Hornsby, H. H., Electrical Exchange.......Chicago.
Hubbard, W. M., Bradford Belting company.......Cincinnati, O.
Hubley, G. Wilbur, Louisville Electric Light company.......Louisville, Ky.
Hughes, W. D., Central Manufacturing company.......Chattanooga, Tenn.
Hull, J. W., Cabinet Manufacturing company.......Steubenville, O.
Humphrey, H. H., Bryan & Humphrey.......St. Louis.
Hunt, Charles B., London Electric company.......London, Ont.
Huntley, C. R., Buffalo General Electric company.......Buffalo.
Hurd, G. A., Crane company.......Chicago.
Hutchins, A. W., D. & W. Fuse company.......Providence, R. I.

Insull, Martin J., C. & C. Electric company....Chicago.
Insull, Samuel, Chicago Edison company.......Chicago.

Jackson, George T., National Conduit and Cable company.......New York.
Jackson, D. C., professor in the University of Wisconsin.......Madison, Wis.
Jampolis, Henry, Chicago Edison company.....Chicago.
Jenney, Charles D., Jenney Electric Manufacturing company.......Indianapolis.
Jennings, John J., Wilkinsburg Electric company.......Wilkinsburg, Pa.
Johannsson, J. E., Wagner Electric Manufacturing company.......St. Louis.
Johns, S. C. D., and wife, Cleveland Electric Illuminating company.......Cleveland, O.
Johnson, Edward H., Sprague Electric company.......New York.
Johnson, J. W., General Electric company....Chicago.
Jones, George H., Chicago Edison company....Chicago.

Kammeyer, C. E., Electrical Review.......Chicago.
Keck, T. P., Brush Electric Light company.......Savannah, Ga.
Kelsch, R. S., Lachine Rapids Hydraulic and Land company.......Montreal, Canada.
Kelly, W. E., Western Electrician.......Chicago.
Keith, Carl, Illinois Electric company.......Chicago.
Kimball, Frederick M., General Electric company.Boston.
Kimbrough, Hal. C., Muncie Electric Light company.......Muncie, Ill.
Kingan, W. F., Edison Sault Electric company.......Sault Ste. Marie, Mich.
Kitt, M. B., Sprague Electric company.......Chicago.
Kittle, E. B., Sprague Electric company.......Chicago.
Knox, G. W., Chicago City Railway company..Chicago.
Knox, J. M., Central Electric company.......Chicago.
Kohler, G. A. Edward, Kohler Bros.......Chicago.
Korst, P. H., Badger Electric company....Racine, Wis.
Kreidler, W. A., Western Electrician.......Chicago.

Lane, T. S., Electrical Exchange.......Chicago.
Lang, A. E., Toledo Consolidated Electric company.......Toledo, O.
Layman, W. A., Wagner Electric Manufacturing company.......St. Louis.
Leslie, E. A., Manhattan Electric Light company.......New York.
Leibrock, C. L., Chicago Edison company.....Chicago.
Lewis, Theodore Graham, Chicago Edison company.......Chicago.
Livsey, J. H., General Electric company..Detroit, Mich.
Lloyd, Herbert, Electric Storage Battery company.......Philadelphia.
Lockwood, Joseph D., Michigan Electric company.......Detroit, Mich.
Long, George.......Chicago, Ill.
Low, W. W., Electric Appliance company......Chicago.
Lowell, James G., Bay County Electric company.......Bay City, Mich
Lucas, R. E., Indiana Rubber and Insulated Wire company.......Marion, Ind.
Lukes, J. B., United States Electric Lighting company.......Washington, D. C.
Luthy, G. G., Royal Electric company......Peoria, Ill.

MacConnell, W. J., Electrical Engineer.......Chicago.
Mahony, Gerald, Lakon company.......Elkhart, Ind.
Manson, George T., Okonite company.......New York.
Marsh, Converse D., Bryan-Marsh company..New York.
Marshall, Norman, Anchor Electric company.....Boston.
Matlock, E. V., Laclede Power company.....St. Louis.
Matthews, W. N., St. Louis Electrical Supply company.......St. Louis.
McDonald, W. B., Commonwealth Electric company.......Chicago.
McGhie, J., General Electric company......New York.
McGill, T. Julian, Westinghouse Electric and Manufacturing company.......Chicago.
McGraw, J. H., American Electrician.......New York.
McKinlock, George A., Central Electric company.Chicago.
McKinlock, W. H.......Chicago.
McQuaide, James P., National Conduit and Cable company.......New York.
Mercein, Thomas R., secretary Northwestern Electrical association.......Milwaukee, Wis.
Merrill, F. L.......Chicago.
Messer, Charles, Dearborn Electric company...Chicago.
Miller, J. H., Springfield Electric Light and Power company.......Springfield, O.
Miller, A. M., Red Oak Electric company..Red Oak, Ia.
Mitchell, O.......Muncie, Ind.
Mold, William S., Star Electric company....Dubuque, Ia
Morgan, H. B., Jewell Belting company.......Chicago.
Morrell, A. W., Miller-Knoblock company.......South Bend, Ind.
Morrill, J. B., Evanston Electric Illuminating company.......Evanston, Ill.
Morgan, Miss Carrie W.......Camden, N. J.
Morse, S. F. B.......Chicago.
Morse, A. M., Atlas-Corliss company.......Chicago.
Mustard, John, Wagner Electric Manufacturing company.......Philadelphia.

Neal, George B., Charlestown Gas and Electric company.......Boston.
Neiler, S. D., Pierce & Richardson.......Chicago.
Nelson, Frederick, Westinghouse Electric and Manufacturing company.......Chicago.
Noe, E. C., General Electric company.......Chicago.
Norcross, E. P.......Janesville, Wis.

O'Connor, Richard, National Carbon company.Cleveland.
O'Hara, J. B., Western Electrician.......Chicago.
Obermeyer, Charles B., Electric Appliance company.......Chicago.
Overbagh, F., Chicago General Fixture company.Chicago.

Packard, W. D., New York and Ohio company.......Warren, O.
Page, A. D., General Electric company..Newark, N. J.
Paige, C. C., Electric Light and Power company.......Oshkosh, Wis.
Patterson, George W.......Chicago.
Patterson, M. E.......Chicago.
Perkins, C. G., Perkins Switch Manufacturing company.......Hartford, Conn.
Perry, F. L., Western Electrician.......Chicago.
Perry, C. C., Indianapolis Light and Power company.......Indianapolis, Ind.
Philbrook, C. H., Walker company.......Chicago.
Phillips, Frank N., American Electrical Works.......Providence.
Pierce, R. H., Pierce & Richardson.......Chicago.
Pillsbury, Edwin S., Wagner Electric Manufacturing company.......St. Louis.
Pimlott, W. E., Sargent & Lundy.......Chicago.
Porter, George F., Kerite wires and cables..New York.
Pratt, Charles A.......Chicago.
Pratt, Frederick S., Cumberland Electric Light and Power company.......Nashville, Tenn.
Prentiss, I. R., General Electric company..Philadelphia.
Price, Charles R., New Bedford Gas and Edison Light company.......New Bedford, Mass.
Price, Charles W., Electrical Review.......New York.
Pritchard, W. R., Westinghouse company......Chicago.
Pumpelly, J. K.......Chicago.
Pyle, James E., Edison Electric Illuminating company.......West Chester, Pa.

Rae, F. B.......Chicago.
Randolph, R. J., Sterling Arc Lamp company.New York.
Ray, William D., Johnson company.......Chicago.
Reber, James C., Dayton Electric Light company.......Dayton, O.
Redman, George A., and wife, Brush Electric Light company.......Rochester, N. Y.
Reeves, J. W., Johnstown Electric Light company.......Johnstown, Pa.
Regester, C. W., Westinghouse Electric and Manufacturing company.......Chicago.
Rex, George P., Columbia Incandescent Lamp company.......Chicago.
Rice, C. W., Kings County Electric Light and Power company.......Brooklyn, N. Y.
Richardson, R. E., Pierce & Richardson.......Chicago.
Richmond, F. S.......Chicago.
Robertson, A. M., Minneapolis General Electric company.......Minneapolis, Minn.
Robinson, D. P., Edison Electric Illuminating company.......Baltimore, Md.
Rockwood, G. O., Rockwood Manufacturing company.......Indianapolis, Ind.
Roehl, Charles E., St. Joseph Railway, Light, Heat and Power company.......St. Joseph, Mo.
Rogers, L. H., Fort Wayne Lamp company.......Cleveland, O
Rose, E. M., Farmington Electric Light company.......Farmington, Ill.
Rosenthal, George D., General Electric company.......St. Louis.
Ross, C. A., Sawyer-Man Electric company......Chicago.

Schayer, John J., Commonwealth Electric company.......Chicago.
Scheeffer, G. A., Diamond Electric company..Peoria, Ill.
Schott, W. H., Commonwealth Electric company.Chicago.
Schuchardt, R. F., Meysenburg & Badt.......Chicago.
Scribner, J., General Electric company.......Chicago.
Searing, George S., Hart & Hegeman company.Chicago
Searles, A. M., Diamond Electric company......Chicago.
Shain, Charles D., Weston Electrical Instrument company.......New York.
Shainwald, J. C., Standard Paint company....Chicago.
Shaw, A. C., Electrical Engineer.......New York.
Shay, J. H., Charles Munson Belting company..Chicago.
Smith, C. R., Manhattan Light, Heat and Power company.......St. Paul, Minn.
Smith, F. E., Lynn and Boston Street Railroad company.......Boston.
Smith, H. S., Sawyer-Man Electric company..Pittsburg.
Smith, T. Ellwood, Somerville Electric Light company.......Boston.
Smith, William M., Chicago Insulated Wire company.......Chicago.
Smith, W. S., Toledo Consolidated Electric company.......Toledo, O.
Stacey, Thomas I., Electric Appliance company.Chicago.

Stearnes, R. S., Fort Wayne Electric corporation ..... New Orleans, La.
Stern, M. L., city electrician ..... Denver, Colo.
Stetson, George R., New Bedford Gas and Edison Light company ..... New Bedford, Mass.
Stieringer, Luther ..... New York.
Sullivan, W. P. ..... Chicago.
Sunny, B. E., General Electric company ..... Chicago.
Syvanus, John, Bullock Manufacturing company ..... Chicago.
Swetland, H. M., Power Publishing company ..... New York.

Tailleur, George, Chicago Edison company ..... Chicago.
Taylor, Frank H., Westinghouse Electric and Manufacturing company ..... Pittsburg, Pa.
Thayer, George L., Belle Plaine Electric Light company ..... Belle Plaine, Ia.
Thorne, J. J., Electric Engineering company ..... Hay City, Mich.
Tompkins, W. H., city electric lighting plant ..... Niles, Mich.
Torbert, H. G., Dubuque Light and Traction company ..... Dubuque, Ia.
Towner, H. L. J., Electric Appliance company ..... Chicago.
Trafman, E. E. R., Engineering News ..... Chicago.
Trego, Charles H., Hoopeston Electric company ..... Hoopeston, Ill.
Trump, Samuel N., Wilmington City Electric company ..... Wilmington, Del.
Tucker, A. L., Western Electric company ..... Chicago.

Upham, W. P., Central Electric company ..... Chicago.
Uptegraff, J. W., Sewickley Electric company ..... Sewickley, Pa.
Urquhart, D. F. ..... T.-H. Carbon company ..... Boston.

Van Trump, C. R., Wilmington City Electric company ..... Wilmington, Del.
Varney, G. E., Varney & McOuat ..... Indianapolis.

Wade, E. E., El Paso Electric company ..... Colorado Springs, Colo.
Wagner, Herbert A., Missouri-Edison Electric company ..... St. Louis.
Walbank, W. McLea, Lachine Rapids Hydraulic and Land company ..... Montreal, Canada.
Warren, Arthur, Westinghouse Electric and Manufacturing company ..... Pittsburg, Pa.
Watriss, A. W., Charles A. Schieren & Co. ..... Chicago.
Webb, A. F., American Carbon company ..... Noblesville, Ind.
Weib, H. E., Solar Carbon and Manufacturing company ..... Pittsburg, Pa.
Weeks, Edwin R., Kansas City Electric Light company ..... Kansas City, Mo.

SEYMOUR SWARTS.

Wells, H. S., Smith-Hill Elevator company ..... St. Louis.
Wells, R. S., Shelbyville Water and Light company ..... Shelbyville, Ill.
Wells, Edward F., Shelbyville Water and Light company ..... Shelbyville, Ill.
Wells, C. J., Electric Appliance company ..... Chicago.
Wendle, G. E., Lycoming Electric company ..... Williamsport, Pa.
Wetzler, Jefferson, Electrical Engineer ..... New York.
Wetzler, Joseph, and wife, Electrical Engineer ..... New York.
Whyte, George S., Leschen-Macomber-Whyte company ..... Chicago.
Wiley, J. R., Standard Underground Cable company ..... Chicago.
Wilkins, E. Ward, Partrick, Carter & Wilkins ..... Philadelphia.
Wilkinson, C. D., Western Electric company ..... Chicago.
Williams, Guy V., Columbia Incandescent Lamp company ..... St. Louis.
Williams, John R., Electric Storage Battery company ..... Philadelphia.
Wilmerding, C. H., Chicago Sectional Underground Electric company ..... Chicago.
Wilson, Charles E., Fort Wayne Electric corporation ..... Philadelphia.
Windsor, H. H., Street Railway Review ..... Chicago.
Wolff, James, New York Insulated Wire company ..... Chicago.
Wood, Elmer E., American Electrician ..... New York.
Woodbridge, J. E., Electrical World ..... New York.
Woolling, Elmer ..... Logansport, Ind.
Woodrow, C. E. ..... Stony City, Ia.
Wormley, J. C. ..... Chicago.
Wright, Porter, Virginia Electric company ..... Norfolk, Va.
Wunder, F. A., Fort Wayne Electric corporation ..... New York.
Warts, Alexander J., Westinghouse Electric and Manufacturing company ..... Pittsburg, Pa.
Wyant, Robert E., Derby Gas company ..... Derby, Conn.

Yates, A. G. ..... Newton, Ia.
Young, E. P. ..... Sewickley, Pa.
Young, John, Western Electric company ..... Chicago.
Young, S. Marsh, Manhattan General Construction company ..... New York.

Zamel, A. G., Zamel Arc Light Meter company ..... Chicago.

The Snoqualmie Power company is experiencing difficulty in securing a franchise to distribute electric power in Tacoma.

Seymour Swarts.

In the accompanying portrait is shown a very good likeness of Seymour Swarts, president of the Swarts Metal Refining company of Chicago. Although comparatively a young man, Mr. Swarts has met with flattering success in the metal-refining business. The company was established in 1885 by the senior Mr. Swarts, and the subject of this sketch took active charge in 1895. Mr. Swarts was born in Chicago in 1868, and has had 17 years' experience in the metal business. His wide acquaintance and close attention to business have enabled him to build up a large trade until, at the present time, the Swarts Metal Refining company is perhaps better known than any concern engaged in a similar business throughout the United States. The principal business of the Swarts company in connection

IMPERIAL OVERLOAD MOTOR STARTER.

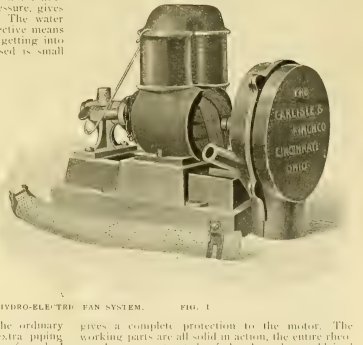
with electric-light and electric-railway plants is the buying and selling of bare copper trolley wire, insulated copper wire, brass and aluminum. Through the energy of Mr. Swarts this business has been built up to such an extent that the company is now doing business with two-thirds of the electric-lighting plants and three-fourths of the electric street railways throughout the country. Mr. Swarts is personally acquainted with most of his customers, and it is safe to say that it would be hard to find a more genial man to do business with. The company bears an enviable reputation, and its dealings with its customers have always given the best of satisfaction. The company started with one small solder kettle and one testing furnace. At the present time it is operating six large kettles and nine furnaces with a capacity of 30,000 pounds of metal per day. This is certainly a good showing and an example of Chicago enterprise.

Hydro-electric Fan System.

The Carlisle & Finch company of 828-830 West Sixth street, Cincinnati, announces a water-driven electric ventilating system, consisting of a water motor designed to be attached to an ordinary bousehold faucet, a small dynamo driven by the water motor and an electric fan motor supplied with current from the dynamo and placed wherever desired. Turning on the water sets the fan in motion and produces a powerful breeze. By this system it is possible to enjoy the delights of the electric fan in apartment buildings or other structures not wired for electric current. The current is of but 20 volts potential and is harmless.

The dynamo end of the combination is shown in Fig. 1. The generator is of the simple horseshoe-frame type, and, at 50 pounds water pressure, gives a current of one ampere at 20 volts. The water motor is of brass, and it is said that effective means are adopted to prevent the water from getting into the dynamo. The quantity of water used is small

FIG. 2.



HYDRO-ELECTRIC FAN SYSTEM. FIG. 1

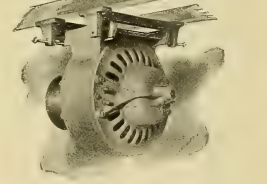
and can be readily carried away by the ordinary waste pipe of sink or bathtub. No extra piping is required, and hose connections are furnished with each dynamo. The weight of dynamo and water motor is 28 pounds. The dynamo may furnish current for experimental purposes, and can be had without the fan.

Fig. 2 shows the electric fan motor driven from the dynamo. The fan can be placed in any part of the house. The wires are light and small and are not unsightly. They may be strung across the floor, back of chairs, over gas jets, etc., being loosely coiled up when not in use. The fan is four bladed and nine inches in diameter. It weighs 10 pounds, and gives a complete protection to the motor. The working parts are all solid in action, the entire rheostat being constructed of handsomely marbleized slate (in all exposed parts) and iron, rendering it fireproof. The resistance is in the form of coils. The smaller sizes of wire are wound on asbestos, and the standard sizes are made to stand the current for 30 seconds under full load. The Imperial motor starter is guaranteed by the company to be the equal of any motor starter on the market.

An electric railway is projected from Clear Lake, Ia., to Klemme, thence to West Lake and Clarion.

Commercial Ironclad Motor.

The accompanying cut shows the new Commercial ironclad motor, which has just been placed on the market by the Commercial Electric company, Indianapolis, Ind. As will be seen from the illustration, it is very compact and attractive in appearance, as well as thoroughly protected from mechanical injury, dirt and dust, while the large lids which are placed on the casing above and below the commutator allow of easy access to the brushes when desired. The method of mounting is admirably adapted for ceiling suspension, as well as for installation directly on the floor or foundations, and when suspended as shown in the cut the operation of the belt-tightening



COMMERCIAL IRONCLAD MOTOR.

device is in no way intertered with. Since there are no bolts to be loosened, the machine can be mounted on its support, as with other ceiling machines. It is extremely convenient for direct belting to elevator machines when used in this way, and the company makes a special reversible motor and controller for this purpose. The magnet frame is of steel, with circular cores and pole-shoes of the same material, thus affording a low-resistance air-gap and greatest possible efficiency of the magnetic circuit, while the end casings which carry the bearings are of cast-iron and are provided with ample ventilating holes. The workmanship and material throughout are of the highest class. The shafts are of steel, with self-oiling bearings.

Carbon brush holders of simple construction and large capacity are used, and, owing to the strong magnetic field, sparking and change of lead are avoided, so that the machines may run for a long time and require little attention. The motors are built in two standard speeds, so that they are adapted to a large variety of uses.

Imperial Overload Motor Starter.

The accompanying cut represents one form of motor starter, having magnetic release and overload attachment, manufactured by the Ohio Electric Specialty Manufacturing company of Troy, O. This starting-box has all the advantages of the regular motor starter, besides protecting the motor from overload due to sudden rush of current, caused by short-circuit or other causes. The overload device is placed in the main armature circuit, and, acting in conjunction with the magnetic release,

New Peru Porcelain Specialties.

The accompanying cut illustrates a few of the new porcelain specialties that have recently been presented to the trade through the new catalogue of the Peru Electric Manufacturing company of Peru, Ind.

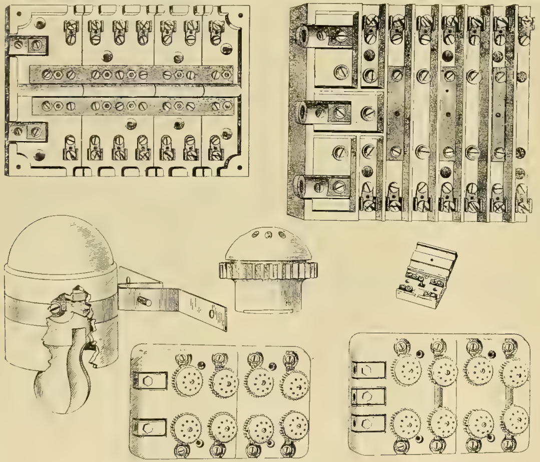
The two-wire multiple-circuit block and the three-wire circuit block, shown in the group, may be extended for any number of circuits desired. The company claims, too, that all multiple blocks built in sections are infringements upon its patents.

The "new Peru plug" will also be readily distinguished in the group. This plug has a capacity of 25 amperes; is arranged to carry a long fuse and has a ventilated cap. This device is all porcelain.

The two and three-wire multiple-circuit tablet boards are also shown. The two-wire tablet board can be built in any number of circuits from four up. It is absolutely fireproof, and all wire and fuses are covered by porcelain. It can be re-fused in a moment's time and the Peru plug can be used instead of switches. The three-wire board, also equipped with the Peru patent fuse plug, can be built, too, in any number of circuits from four up, and all its fuses and connectors are covered by porcelain. This is very much the same design as the two-wire board, and is absolutely fireproof, and can also be re-fused in a moment's time.

The Peru porcelain transformer fuse plug is a specialty that is well worth investigating. In this fuse-block there is no iron for the current to leak over or jump across. The plug is ventilated for the escape of gas and carries an extra long fuse. The contacts are excellent, and the fuse is easily inserted in the box. The manner of fastening the box to any support as, for instance, a house or a pole, is such as to provide perfect ventilation and insure freedom from moisture.

Another valuable specialty is the Peru covered porcelain mains, represented by the smallest cut in the group. The one shown has a capacity for 10 amperes.



NEW PERU PORCELAIN SPECIALTIES.

Western Union Statement.

The increased use of the telegraphic service by newspapers and the government during the war makes the financial statement of the Western Union Telegraph company for the quarter ended June 30th (estimated) and for the fiscal year of special interest. For the quarter the net revenue increased over 1897 about 15 per cent. Of the increase in net for the year, amounting to $430,000, over half is shown in the present quarter. The quarterly statement is as follows:

	1898.	1897.	Increase.
Net revenue	$1,750,000	$1,509,682	$240,318
Interest on sinking fund	221,450	247,921	*26,471
Balance	1,528,550	1,261,761	266,789
Add sinking fund	....	40,000	*40,000
Balance	1,528,550	1,301,761	226,789
Dividend 1¼ per cent	1,216,980	1,216,967	13
Surplus	[illegible]	84,794	226,776
Previous surplus	[illegible]	[illegible]	167,621
Total surplus	[illegible]	[illegible]	388,400

The statement for the year is as follows:

	1898.	1897.	Increase.
Net revenue	[illegible]	[illegible]	$130,685
Interest on sinking fund	[illegible]	955,501	*28,921
Balance	[illegible]	[illegible]	[illegible]
Dividend 5 per cent	[illegible]	1,792,855	[illegible]
Surplus	[illegible]	[illegible]	[illegible]
Previous surplus	[illegible]	[illegible]	[illegible]
Total surplus	[illegible]	[illegible]	388,400

*Decrease.

The directors have declared the regular quarterly dividend of 1¼ per cent., payable July 15th. The books will be closed June 20th and will be reopened July 1st.

CORRESPONDENCE.

New York Notes.

New York, June 7.—Many well-known eastern electrical men are in Chicago attending the convention of the National Electric Light association. The electrical exhibition here closed on Saturday night. It is said that many of the exhibitors have accepted the offer of the New York State Agricultural society to transport their exhibits to the annual state fair in Syracuse, which will be held in the latter part of August and the early part of September, free of charge, and to give them free space for exhibition. The State Agricultural society recently sent a committee to visit the exhibition in Madison Square Garden, and the committee was so much impressed with the display that it immediately decided to offer such inducements as to make an electrical display a star feature of the fair.

The bogus stock-ticker game, with variations, has been worked again in this city. Henry Summerfield, Peter Williamson and John Burke were held in $1,000 bail each in the Yorkville Court on Saturday, for examination on a technical charge of larceny. Police Captain Kane told Magistrate Flammer that the prisoners conducted a bogus poolroom over a restaurant at 673 Third avenue. They pretended to have tapped the Western Union wires, and by this means to be able to get race-track news 15 minutes ahead of any other poolroom in the city. They let it be understood about the neighborhood that they could give the result of a race in time for a customer to go to a poolroom and bet on a sure thing. The captain said he had one witness who paid $90 for such a "tip," and placed a bet on a horse that came in last. When the detective entered the place on Friday night one of the prisoners had his coat off and was sitting at a table ticking a telegraph instrument connected with a wire which ran up the chimney and which was supposed to be connected with a Western Union wire. Investigation showed that it had no connection with any other wire. Summerfield was said to be the manager of the place. The captain told the magistrate that the manager's picture was in the Rogues' Gallery at police headquarters. The police seized the telegraph instruments and several dry batteries when they made the arrest. Summerfield acknowledged that he owned the property, but denied that he had tapped any wires. He asserted that it was his intention to put in a private telephone wire, in order to get early race-track news from an office downtown. Captain Kane said the men had been in the Third avenue place for about two weeks, and had a dozen men about the neighborhood on the lookout for customers. The prisoners were unable to give bail and were locked up.

Bernard Moebius, the inventor of the electrolytic process of parting and refining gold and silver which bears his name, died on board the Kaiser Wilhelm der Grosse, while on his way to his old home in Germany. Mr. Moebius succeeded in 1884 in solving the problem of economically and rapidly extracting the precious metals from their ores by electricity. He improved his invention in 1895, and now both the old and new processes are in successful operation in Europe, Mexico and the United States. The plants at Frankfurt-am-Main, Perth Amboy, Pittsburg and Denver are the best known, and are described in detail in the leading text-books on metallurgy and electricity. Mr. Moebius was born in Hartha, Saxony, in 1852. He received an academic education and studied chemistry and metallurgy in Germany. He engaged in mining in German, Austria, Spain and Mexico before settling in the United States, of which he became a citizen. He was a leader in his profession, and, though a reserved man, was genial and won many friends. He was a member of numerous scientific associations and of the Arion society of this city.

M. S.

Canadian Intelligence.

Ottawa, Ont., June 6.—A deputation from the city of London, Ont., has been in Ottawa to ask the Dominion government to grant a bonus of $100,000 to aid in the construction of the proposed electric railway from London through Stratford, Arcona and Thedford, connecting with the Canadian Pacific and Grand Trunk railways.

The Eugene F. Phillips Electrical Works of Montreal have been awarded the contract to supply all the trolley, bond and feed wire required in the construction of 25 miles of electric railway at Jamaica, W. I.

The Montreal Cotton company is increasing its power plant, which at present consists of two 400-kilowatt three-phase alternators and 1,000 horse power capacity in induction motors, by the addition of two more 600 horse power generators of the same type and 1,200 horse power in induction motors.

The shareholders of the Hamilton, Grimsby and Beamsville Electric railway of Ontario held their quarterly meeting recently. The quarterly financial statement showed an increase of 10 per cent. in gross earnings over those of the corresponding period last year. The directors were empowered to issue debentures to pay off the floating debt of $20,000. The present debenture debt of the road is $85,000, payable in 30 years.

Mr. Elisha Moore of Meductic, York county, New Brunswick, has invented an alternating switch for street railways, which can be operated from the car by simply pressing a button. The device obviates the necessity of stopping the car and does away with switchmen, which means a great saving to railway companies. Mr. Moore has patented his device, both in Canada and the United States, and will now apply for European patents.

The city engineer of Toronto, Ont., has been negotiating with a company of Buffalo capitalists for the transmission of electric power to Toronto. The company offers to supply electric energy at $40 per horse power per year, if the city guarantees that it will take not less than 10,000 horse power. The company proposes to operate from a point 30 miles nearer Toronto than Niagara Falls.

The British Columbia Electric Railways company of Victoria, B. C., is having installed a complete plant for developing the water power at Goldstream, for operating the street railway and the electric-light plant. The work is being done under contract by Hasson & Hunt, mechanical engineers of San Francisco, Cal., and the plant is expected to be in operation by midsummer. The power house will be stationed at Goldstream, about 12 miles from Victoria. The contracts for the electrical and hydraulic machinery have been closed, and the construction is being pushed with rapidity. The electrical apparatus will be of the Canadian General three-phase type, using rotary converters and transformers to distribute over the line as the two-phase with a voltage capacity of 11,000. Two Pelton water-wheels will be used, with a capacity of 600 horse power each, delivering 1,000 horse power in Victoria. Provision is also being made for 600 additional horse power if required. The power delivered in Victoria will be sufficient to operate the street railway, electric-lighting system, commercial and municipal, and also to furnish considerable power for the operation of stationary motors for manufacturing purposes, elevators, etc.

The Montreal Street Railway company has just had printed 15,000,000 car tickets, the cost of printing being $1,100. The company is said to have received the large sum of $3,000 for the advertisements printed on the tickets.

Mr. Mark Eschwege of Vancouver, B. C., representing a syndicate of French millionaires—the Anglo-French Telegraph company—which has a capitalization of $500,000, has received a cable message ordering him to commence a survey at once for a cable from Vancouver to Dyea, Skaguay and Wrangel. The head office will be at Vancouver, and there will be offices at Victoria, Dyea, Skaguay, Wrangel and Dawson. The cable is now being manufactured in Europe.

The Dominion government has decided to remove the meteorological observatory from Queen's Park, Toronto, owing to the disturbance of the street cars of that city, to Agincourt, some miles distant, where the work of the institution can be effectively carried on. The building to be erected there will consist of a circular stone underground chamber of some 30 feet in diameter, topped by a brick structure for the making of absolute determinations. In the underground room, in profound darkness, only

relieved by two tiny jets of gas, the needles of vertical force, horizontal force and the declinator will make photographic pictures of the earth's magnetic currents. The utmost care will be exercised in its erection, and every stone put into its walls will be tested to ascertain that it contains no iron matter to disturb the delicate working of the magnetic instruments within.

The railway committee of the Privy Council, at Ottawa, has granted a charter to the North Shore Electric Railway company, which proposes to build a railway in the vicinity of Montreal, connecting Montreal with outlying districts. This road will run from Three Rivers, Que., along the north shore of the St. Lawrence. The promoters of this enterprise intend to use the water power of Shewanegan Falls for the generation of the necessary power wherewith to operate the road.

The Montreal and Southern Counties Railway company, which obtained its charter last year, has been given power by the railway committee to extend its operations to the counties of Beauharnois, Chateauguay, Huntingdon and Napierville, Que. The company is given powers for connecting with other railway companies or crossing the St. Lawrence, and for amalgamating with other companies, but the company is debarred from running along the streets of Montreal or the adjoining municipalities. Powers are also given to run steamers, maintain pleasure grounds and sell electricity for light, heat or power.

The Cataract Power company of Hamilton, Ont., is engaged on an immense undertaking in the county of Welland, Ont., for the purpose of creating electricity on a large scale with a view of supplying power to every business industry that may require it in its line of route of upwards of 40 miles. At the De Cew Falls a very large reservoir is in course of construction, the water for which will be supplied from the Welland Canal at Allanburg, which is itself fed from Lake Erie, and which stands at a considerable elevation above the site of the new reservoir. Seven or eight other storage reservoirs are being made between De Cew Falls and Allanburg, so as to have an abundant supply of water always on hand. At the De Cew Falls a large power house has been erected and the water will be carried from the reservoir through pipes 12 feet long by eight feet in diameter, the fall from the reservoir to the power house in the valley below being about 100 feet. The company proposes to sell the electricity all along the route of 40 miles to Hamilton, for electric lighting or motors for manufacturing purposes, and will be prepared to increase the power at any time it may be required. The work is being done by contract, and at the De Cew Falls end there are some 200 men at work, with about 100 teams of horses, working excavators, etc. The job is to cost $1,000,000. The work has been going on for about eight months, and is expected to be completed some time in the coming fall.

Mr. Peter Trudeau of Ottawa, inventor of the electric heater controlled by the Dominion Electric Heating and Supply company of this city, visited Philadelphia recently to give an exhibition of the capacity of his heater. Mr. Hewitt, engineer of the Union Traction company of that city, conducted the tests as against the best heaters now in use in the United States. Mr. Hewitt's official report, just received, declares that the results indicate that the Ottawa heater is the most economical in the use of electrical energy at the temperature maintained. The only question to be settled to determine the sale of the right to manufacture the Ottawa invention in the United States for a considerable sum of money, is the durability of the heater. The heaters have now been in use for two years in the Lachine power house, and show no symptoms of wear, though the copper resistance has been kept at a red heat for months.

A. V. W.

PERSONAL.

Mr. R. J. Randolph, formerly western manager for the Excelsior Electric company, has gone to New York, to become general sales manager of the Sterling Arc Lamp company.

J. J. Schoenleber, manager of the Northwest Engineering company of St. Paul, was in Chicago this week on his way home. Mr. Schoenleber has been enjoying a well-earned vacation.

ELECTRIC LIGHTING.

The park commissioners of San Francisco are preparing extensive plans for the improvement of Golden Gate Park. It is proposed to expend $9,500 for electric lighting. In addition to this, $6,500 is estimated as the cost of extending the electric lights to the beach.

The Bulletin des Usines Electriques, in an article discussing the question of extending the time of the concession for lighting Paris, gives a few interesting details about electric lighting in Berlin. It says that there are 300,000 incandescent lamps of 16 candle power connected, besides several thousand arc lamps. The length of mains is about 186 miles, and the power developed is about 28,000 horse power. There are also 1,600 motors, taking 6,450 horse power. The price of current for lighting is 15 cents per kilowatt-hour, for power four cents. Paris will require about 25,000 horse power. It is proposed to complete a system comprising 418,000 incandescent lamps of 10 candle power and 7,448 arc lamps, and about 240 miles of mains. There will be 513 motors requiring 1,940 horse power, and the cost will be about 23 cents per kilowatt-hour.

Electric lighting, especially for household purposes, is rapidly progressing in Egypt. It is offered at cheap rates, and is far preferable in the Egyptian climate, to the very ordinary quality of gas supplied by the gas company in Cairo, which has been granted a concession to supply electric light. Only two trains on the government railway are at present equipped with electric lights. The gas company mentioned has engaged to light all Cairo by electricity in lieu of gas, and it is confidently expected that Alexandria will soon adopt the same method.

ELECTRIC RAILWAYS.

Oscar T. Weber filed a petition, June 2d, with the supervisors of San Francisco for a franchise for a street railway commencing at the junction of Fillmore and Francisco streets, extending along Francisco to Jefferson, thence along Jefferson to the Presidio Reservation.

A 50-year franchise has been granted the Geneva Lake, Sycamore and Southern Electric Railway company for a line to run from Geneva Lake, Wis., to Morris, Ill. The road is to be a single track of uniform gauge of four feet 8½ inches, and the rails to be used are to be the uniform T-rail of 45 pounds weight per yard. The road is to carry passengers, mail, express and freight, and its general office will be located at Sycamore. The length of the proposed road is 110 miles, and it crosses 10 lines of roads, nine of which lead to Chicago, one connecting with Milwaukee. The president of the company is James Branen; secretary, George B. Morris; treasurer, George Brown; general manager and promoter, John B. Whalen; directors, A. K. Bunker, John R. Kellogg, Emil Arnold of Woodstock, A. G. Whilte, S. Baker of Sandwich, H. F. Jones of Hebron, D. S. Brown of Genoa, P. T. Parkhurst, Loren Woodard and F. W. Patrick of Marengo, Edward Delany of Cortland, and the officers. The company was incorporated January 13, 1898.

POWER TRANSMISSION.

The Edison Electric company of Los Angeles, Cal., has obtained control of the Southern California Power company of Redlands, and the two corporations have been practically consolidated, with headquarters in Los Angeles.

Notice is given that an application for franchise to erect poles and wires for transmission of electric power and for lighting purposes at Antioch, Cal., has been made by W. C. Myers, and bids for the franchise will be received by the city clerk up to 10 a. m., July 5th.

According to the Auburn, Cal., Herald of May 28th, it is reported that the South Yuba company is preparing to put in another powder plant to be located on the ground of the present electric-light works. This new plant will be auxiliary to the one at Newcastle, and the power will be utilized at Sacramento.

The Kern-Rand company—one of the comparatively large number of electrical water-power transmission companies in California—will generate about 2,000 horse power at its plant on the south fork of the Kern River for transmission to Randsburg and the desert mines. Water will also be supplied for irrigation.

The San Gabriel Electric company has nearly completed its work of establishing a great electric plant in the San Gabriel Cañon, by which electric power is to be transmitted over seven copper wires to Los Angeles, Cal., 22 miles from the mouth of the cañon. It is expected that the line will be completed by the latter part of this month, and its ultimate capacity will be 3,500 horse power delivered, after deducting all losses in transmission. On the pipe line there are no less than 38 tunnels, aggregating 22,000 feet in length.

The Azusa (Cal.) Pomotropic states that some of the projected electric-power systems are liable to prove a menace to irrigation, as they seek to gather a number of small mountain streams from their natural courses into pipes, thus leaving the canons through which they flow without water, in which case a large amount of vegetation must die, and thus tend to the denudation of the mountains and the diminishing of the water supply. It is claimed that the government should grant no privileges on reservations without first making careful inquiries into the effect of the proposed works on irrigation rights.

TELEGRAPH.

In London there is a lodge of Freemasons known as the Telegraph Cable Lodge. At a recent meeting W. O. Smith was elected master, succeeding O. Moll of the Direct United States Cable company.

A 7,000-ton telegraph cable-laying ship is now in course of construction at Barrow, England.

The New York Sun recalls that the cable dispatch sent by Secretary Seward to the French government at the close of the Civil War, announcing that Mexico must be evacuated by foreign troops, cost $15,000. The cable service was in its infancy, and communication through it was very costly. Secretary Seward did not economize his words, but talked as fluently and went into as many details as though he were seated at a table opposite the French minister of foreign affairs. The dispatch resulted in the withdrawal of the French troops, and this led directly to Maximilian's tragic death at Queretaro in June, 1867.

ELECTRICAL SECURITIES.

For the first quarter of the present year the Westchester Electric Railway company earned gross $25,361, an increase of $1,031, and net $4,154, an increase of $1,276. The general balance sheet shows cash on hand $1,599 and a deficiency of $9,177.

The New Orleans Traction company reports gross earnings for April of $109,065, an increase of $5,075 as compared with the same month of last year, and net $44,713, an increase of $7,533. For the four months ended April 30th, the gross earnings were $441,440, an increase of $19,763, as compared with the corresponding period of last year, and net $186,418, an increase of $37,872.

There was a phenomenal advance of 20 points in the price of Chicago City railway stock on Saturday, June 4th. The market for the stock was a repetition of that on Saturday, three weeks ago, when the price suddenly jumped from 235 to 250 on buying of a few hundred shares. Since then it fluctuated between 245 and 250, and closed at the latter figure June 3d. The following day it opened at 255, at which a 100-share lot changed hands. The next sale was of 10 shares at 260. Then seven shares brought 265, and the next and final sale was of 12 shares at 270. At the close the biggest buyer on the advance bid 270 for any part of 5,000 shares. At 270 the 12 per cent. dividend of the company is equal to 4.44, but the company really earned in 1897 5.09 per cent. on its capital stock, figuring its value on a basis of $270 per share, and this year the earnings of the property have shown good increases.

MISCELLANEOUS.

A telegram just received in Chicago states that the patent of the H. B. Camp company of Aultman, O., on the mandrel for manufacturing conduit ducts has been sustained.

Lieut. W. D. Weaver, editor of the American Electrician, has received his commission as passed assistant engineer in the United States Navy, with the rank of lieutenant, and has been assigned to one of the monitors.

The Navy Department will shortly install a number of electrical machines in the New York navy yard, and for that purpose is inviting sealed proposals until June 28th, for furnishing the following electrical equipment: One 100-kilowatt, 125-volt generator; six two horse power, 110-volt, enclosed, portable motors; two five horse power motors, two 10 horse power motors and one 20 horse power motor. Deliveries are to be made within 60 days after date of contract. Prospective bidders can obtain specifications and blank forms of proposals upon application to the Navy Pay Office, New York, or to the Bureau of Supplies and Accounts, Washington, D. C.

TRADE NEWS.

The Attica Electric Light company, Attica, Ind., is increasing its plant by the addition of a 125 horse power Ball engine, built by the Ball Engine company, Erie, Pa.

As Mr. E. R. Mason, in charge of the Chicago office of the Mason Electric Equipment company, has been called into active service as a member of the naval militia, it is requested that, for the present, all orders be sent to the St. Louis office of the company, 314 Security building. Mr. E. R. Mason is a son of Mr. W. R. Mason, who has another son in the naval militia. It is to be hoped that the company will lose nothing by the patriotism of the young men.

The K & W. company of Pittsfield, Mass., manufacturer of the Hardy incandescent lamp, reports fine trade. The Hardy lamp has a deserved popularity among central-station men who consider quality and sustained candle power and efficiency in their lamps. The company's trade in arc hanger-boards, dynamo brushes and commutator compound has been the largest since the organization of the company. Meysenburg & Badt, 1504 Monadnock building, Chicago, are the western representatives of the company.

The Bryant Electric company of Bridgeport, Conn., is erecting a new two-story power house, 50 feet square. The building has brick side walls and the framework is of the steel skeleton type. The floor of the building is supported on heavy girders and columns, which carry steel joists supporting corrugated iron arches and concrete floor. The roof has clear span trusses carrying corrugated iron covering, lined with patent anti-condensation roof lining, which prevents the condensation of moisture on the under side of the roof covering and avoid any damage or inconvenience from moisture dropping on the delicate machinery or material on the floor below. This building was designed and th

steel material furnished and erected by the Berlin Iron Bridge company of East Berlin, Conn.

BUSINESS.

Bulletin 4-F of the Western Electric company relates to alternating-current ceiling and desk fan motors. Descriptions and prices are given.

Paragon fan motors are listed in a leaflet issued by the Chicago Edison company. Prices, dimensions, capacity and style of finish are given for wall, bracket, duplex and desk fans.

Roth Bros. & Co., Chicago, are placing on the market the well-known Roth fan motors, for which the demand is constantly increasing. The Roth company calls attention to the prices on these goods.

The Central Manufacturing company, Chattanooga, Tenn., is kept busy filling orders for yellow pine cross-arms, oak and locust insulator pins and brackets, which are coming in from all parts of the United States. Its goods are giving satisfaction to all those who use them.

M. B. Austin, western manager for the Safety Insulated Wire and Cable company, has taken as a partner W. A. Browne, and hereafter the firm will be known as M. B. Austin & Co. Mr. Browne, for number of years, was in the coal business. In the new firm Mr. Browne will attend more particularly to office affairs, while Mr. Austin will continue to handle the company's outside affairs.

The Central Electric company of Chicago reports a brisk trade in Westinghouse alternating-current fan motors. One reason for this is undoubtedly the fact that the company is carrying large quantities in Chicago stock, and hot orders in hot weather can be filled immediately. The Central company has also a number of new specialties in its house-goods department, prominent among the number being a new device for electrically lighting the incandescent gas or Welsbach burner. This is a very simple device, and will doubtless be appreciated by those who have been asking for a device of this character.

The St. Louis Electrical Supply company recently sent out a very novel and interesting postal card as an advance notice for its salesmen. While it is impossible to go into the design in detail, it may be said that it is based upon the expression "We will play ball in your town about — date, with the salesman at the bat, and Packard incandescent lamps, O. K. weatherproof wire, and telephone goods respectively on the first, second and third bases, Emerson fan motors right field, Western Electric direct-current fan motors center field, lightning arresters shortstop, with Bryant porcelain goods for catcher." This little specialty will, without doubt, help the company's salesmen.

In making soldered connections on telephone switchboards and elsewhere in telephone work, when it becomes necessary to solder wires of small diameter, it is very essential to have a high-grade soldering flux. A soldering flux which will not injure the wire in any way and at the same time will make a quick and sure joint is very much to be desired. The Electric Appliance company claims that it has something which fills all of these requirements in its Highland soldering paste, which is now being used very largely for telephone work and for fine instrument work generally. The company is giving customers an opportunity to test this paste by sending free of expense small sample boxes.

The W. R. Garton company of Chicago, which succeeds W. R. Garton, has recently moved into handsome and commodious quarters, 807 Ashland block, where as consulting engineers and manufacturing agents the members of the company are admirably situated to promptly meet the demands of street railways, electric-light and power companies, as well as to vigorously push their line of new agencies. This company represents some of the largest and most reputable manufacturers in the country, as evidenced from the list: The Central Union Brass company, Keystone Electrical Instrument company, Crouse-Hinds Electric company, Duquesne Forge company, Pittsburg Steel Hollow-ware company, Massachusetts Chemical company, Billings & Spencer company, Raster carbon rheostats, Garton lightning arresters, Liberty Lamp company, William E. Klein & Co., C. S. Knowles, Bound Brook trolley bushings, Pittsburg trolley poles and Morrell's commutator bars. The company reports that business is exceedingly good. It reports having closed several large contracts for Raster carbon rheostats, as well as having had a splendid business in Keystone electrical instruments, Garton lightning arresters, Billings & Spencer drop-forged commutator bars, etc. This company carries in Chicago a large stock of wire and cables and all kinds of tape. It will also make a specialty of the calibration and repairing of instruments.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued May 31, 1898

604,712. Electrical Signaling System and Apparatus. Walter F. Banks, Milford, Conn. Application filed October 1, 1896.

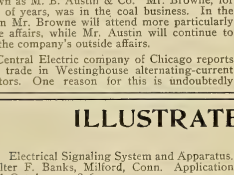
The mechanism employed includes signal wheels, circuit controllers, a switch-lever for putting one or the other of the circuit controllers into the line, and a short-circuiting lever for short-circuiting the circuit controllers, and a spring connecting the short-circuiting lever and the switch lever.

604,729. Elevated Electric Car Line. Joe H. Cooley, Paris, Texas. Application filed August 13, 1897.

Features of construction embodied in this plan include a single line of posts with cross-beams attached, braces, supporting girders and cross beams, in like manner cross ties supporting a single rail for car-wheel groove, a system of vertical and longitudinal frame work supporting two upper rails for each track, upper cross-beams attached to posts supporting electric wire supports.

604,747. Electric Railway. John H. Guest, Boston, Mass. Application filed October 20, 1896.

A switch-operating magnet has spool heads fitted into a containing tube having a seal at its end through which permanent magnet connections pass and in which they are hermetically sealed.



NO. 604,729

604,770. Pneumatic Atachment for Telegraph Keys. William J. Lieb, Pratt, Minn. Application filed April 15, 1897.

A pneumatic attachment for telegraph keys is described comprising an outer wall, a diaphragm, means for securing the device to a key botton, and a tube leading into an air chamber formed by the outer wall and the diaphragm

604,806. Electrical Belt. Andrew J. Taylor, Vineland, N. J. Application filed April 12, 1898.

An electro-galvanic belt consisting of a sheath, hook plates attached thereto, a battery detachably connected to the hook plate within the sheath, and battery electrodes arranged outside of the sheath and having a hinged connection with the sheath and electrical connection with the hook plates in the battery

604,842. Electric Motor or Dynamo. Andrew L. Riker, New York, N. Y. Application filed November 24, 1897

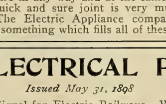
An armature frame is described comprising a spider having radial arms grooved longitudinally in their outer surfaces, [illegible] surrounding and supported by the spider and provided in their inner edges with cuts corresponding to the grooves, end plates [illegible] provided with bolt holes, and fastenings [illegible] the arms and rings.

604,843. Former for Winding Armature Coils. Andrew L. Riker, New York, N. Y. Application filed November 19, 1897

A coiling frame is the principal feature comprising two parts having a winding space between them, and grooves or winding channels in each part transverse to the plane of the winding space, those in one part being on the face of the former and those in the other part in the rear thereof.

604,866. Signal for Electric Railways. William H. Jordan, Brooklyn, N. Y. Application filed February 16, 1897.

One claim is given: In an electric railway, the combination with the main or working conductors of two electromagnets for controlling a signal, said magnets being independently connected between one of the main or working conductors and two distant contact plates located in close proximity to the same conductor, and which contact plates are adapted to be electrically and successively connected with the other main or working conductor through the contact devices and circuit connections of a moving vehicle.



NO. 604,749

604,874. Safety Device for Electric Carriages. Reginald T. D. Brougham and Walter C. Bersey, London, England. Application filed December 13, 1897.

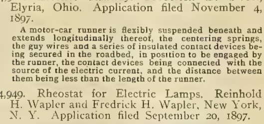
The combination is claimed of a closed box, a keyhole leading into the box, two open contacts within the box remote from the keyhole and connected to the circuit wires and a key so shaped that it passes through the keyhole and when the key is turned connects the contacts.

604,911. Electric Railway. Frederick D. Sweet, Elyria, Ohio. Application filed November 4, 1897.

A motor-car runner is flexibly suspended beneath and extends longitudinally thereof, the centering springs, the guy wires and a series of insulated contact devices being secured in the roadbed, in position to be engaged by the runner, the contact devices being connected with the source of the electric current, and the distance between them being less than the length of the runner.

604,949. Rheostat for Electric Lamps. Reinhold H. Wapler and Fredrick H. Wapler, New York, N. Y. Application filed September 20, 1897.

In combination with the ordinary incandescent electric lamp it is proposed to employ two heads of insulating material, a socket connection upon one head for the incandescent lamp, and a socket connection on the other head for the socket or electric lamp fixture, a rheostat coil between the insulating heads, a bar also between the heads, a sliding contact in the electric circuit and upon the bar and resting upon the rheostat coil and having a knob or head by which it is adapted to be moved toward one head or the other for varying the resistance in the lamp circuit, and a casing of sheet metal multiperforated and surrounding the rheostat and bar to protect the same and allow a free circulation of air, the casing being slotted for the knob or head of the sliding contact.



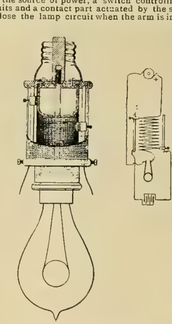
NO. 604,842.

604,968. Automatic Current Distributer for Electric Railways. Jean Claret and Olivier Vuilleumier, Paris, France. Application filed May 4, 1897. Patented in France June 8, 1895, and November 18, 1895; in Germany November 27, 1895; in Switzerland December 2, 1895, and in Spain February 4, 1896.

A distributer for an electric railway having a series of switches to be connected to the spaced contacts of the railway contact arms, to contact with the switches, the spacing of the axes of these contact arms being less than the spacing of the axes of the switches, and an electric motor to move the arms, the motor armature having a commutator provided with fingers electrically connected with the coils of the electromagnets of the motor, and contacts for the fingers electrically connected with the arms.

605,013. Switching Device and Circuit Arrangement for Electrically Propelled Vehicles. Emil B. W. Reichel, Berlin, Germany. Application filed January 10, 1898.

This circuit arrangement for electrically actuated vehicles consists of motor, accumulator and lamp circuits, a switching or trolley arm adapted to be connected with an external source of power and the motor circuit, a contact piece connected therewith, a contact part adapted to be engaged by the contact piece and insure the electrical continuity of the remaining circuits when the arm is connected with the source of power, a switch controlling these two circuits and a contact part actuated by the switching arm to close the lamp circuit when the arm is in a position of rest.



NO. 604,949.

605,023. Electric Switch for Use with Electrically Propelled Vehicles or Locomotives, Etc. Albion T. Snell and Charles E. Grove, London, England. Application filed October 8, 1897.

A compound switch comprises among its members a starting switch and a controlling switch for coupling the motors in different relations, and mechanism for imparting an intermittent movement to the controlling switch from the starting switch.

605,026. Globe for Incandescent Lamps. Victor de Spruner-Mertz, Brussels, Belgium. Application filed November 18, 1897. Patented in Germany July 30, 1896.

A lamp globe is formed of transparent material and consists of a double conical portion truncated at one end, a narrow conical portion, and an intermediate bulging and annular portion integrally connecting the two first-named portions, the walls of the truncated member of the double conical portion and the conical portion being lined with reflecting material and being substantially parallel and the source of light being adapted to be situated between the annular portion and the extreme end or tip of the globe.

605,066. Third-rail Underground Electric-railway System. Louis E. Walkins, Springfield, Mass. Application filed August 21, 1897.

The system employs a rail conductor, a trolley or shoe having terminals or binding posts, a holder plate for the shoe, on which the same is vertically yieldingly supported, arms for the holder plate, whereby the same may be supported from the motor car or truck, and wires running to connection with the binding posts of the shoe, independent of the holder plate and its supporting arms.

Western Electrician.
EVERY SATURDAY.
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Northwestern Electrical Association.

The midsummer meeting of the Northwestern Electrical association, as announced last week, attracted a large number of central-station men and manufacturers who had been in attendance at the Chicago convention of the National Electric Light association, and when the magnificent steamer Northwest left the dock on Friday afternoon, June 10th, it carried many prominent electrical men from all parts of the country.

The start was made between the showers that visited this city last week, and although there was a violent storm during the afternoon, no ill effects were felt by the convention party, and, aside from the disappointment of being compelled to remain under shelter, there was really no inconvenience experienced. It merely afforded an opportunity to prove the excellent seagoing qualities of the boat.

When the steamer arrived at Milwaukee it was greeted by a large delegation of electrical people and their friends. Several joined the party at this point and the boat then proceeded on the route outlined in the Western Electrician of June 4th.

Convention Proceedings.

The convention was called to order at 8 p. m. for the purpose of arranging a programme. The secretary announced that stops would be made at Mackinac, the Soo and at Houghton, and that it was expected the steamer would reach Duluth on Monday night, June 13th. He added that there would be a reception tendered the members of the association at Sault Ste. Marie, and that an inspection of the government canal had been especially arranged for the benefit of the members of the association, that a stop would also be made at Houghton long enough to permit of a visit to the famous copper mines there, and that suitable arrangements had been made for the entertainment of the members and visitors.

Professor Ichisuke Fujioka of Tokyo, Japan, was introduced. He promised to address the convention on the subject of the "Electrical Industry in Japan," adding some comments on the subject of electrical education there.

It was announced that Professor Elisha Gray of Highland Park would deliver an address during the convention, at an early session.

The secretary announced also that an address would be delivered by A. J. Wurts of Pittsburg during the trip, and that other addresses would be announced later.

Announcement was made that W. F. Barker, gas commissioner of Massachusetts, would also deliver an address.

Arrangements were made to place a question box in position to receive queries for consideration and discussion during the sessions.

An adjournment was then taken until June 11th at 11 a. m.

The second session of the convention was called to order by the president, F. A. Copeland, who introduced S. Everett Doane of Marlboro, Mass., the author of a paper on "Incandescent Lamps," after the reading of which a vote of thanks was extended to Mr. Doane. During the reading of his paper Mr. Doane called attention to the fact that the old theory that the evaporation of carbon and condensation on the bulb of the lamp was the cause of blackening had been exploded, and that the generally received theory at present, which was undoubtedly correct, was that the blackening is a truly chemical effect.

The question box was then opened by the secretary and found to contain the following questions:

The first question is: "Would like to know the experience of any central stations represented having competition from isolated acetylene gas or isolated gasoline plants."

The second question is: "What success has been realized in substituting an incandescent lamp in place of wire resistance in direct current enclosed arc lamps?"

J. W. Mabbs, Chicago: I have had a little experience in the line suggested by question No 2. Some two or three years ago I conceived the idea that the resistance in an incandescent lamp was wasting a great deal of energy which ought to be utilized as light, and I tried quite a number of experiments, by taking incandescent lamps and putting them in multiple series with the incandescent arc. I had quite a little trouble to get the incandescent lamps to work satisfactorily, owing to their faulty construction, but after a little we got the thing down so that the lamps worked pretty well. The arc lamps worked much better than they did with the metal resistance, and the smaller lamps gave more or less light that we utilized for places where a little aberration in light would not be objectionable, and in that way put the energy formerly thrown away to good use in lighting spaces where a variable light would not be objectionable. During the two or three years that we have used the incandescent lamps in connection with the arc lamps, in this way, we have been put to less trouble and expense for repairs than when we used the lamps with the metal resistance. By putting about six lamps of 10 candle power in multiple series, each one consuming about an ampere, we get very good results.

Mr. Harding: The better service that you obtain from your arcs, I presume, is due to you having less trouble in maintaining the lamp.

Mr. Mabbs: Yes, sir. I think the main benefit derived is in having the heat from the resistance kept away from the lamp. The insulation is injured by the resistance in the lamp, and by putting this resistance in incandescent lamps it removes the heat from the arc lamp, and in that way lengthens the life of the arc lamp.

Mr. Wurts: Does the breakage of one of the lamps render them all useless?

Mr. Mabbs: We use about four watts in these lamps, and in that way we figure that five lamps will carry the current necessary to run the arc lamp and we keep close enough watch of them so that if one burns out we replace it immediately, and in that way avoid the loss the of the entire lot. If two burn out, however, generally the whole lot goes.

Mr. Wurts: How many have you been operating in that way?

Mr. Mabbs: About eight or 10. The reason that we have not used more in that way is because the light derived from the incandescent lamps will fluctuate considerably for instance, a 10 candle power lamp ranges from 8½ to 12 candle power which would be quite objectionable where a continuous light is needed. But for lighting pa-

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sages, and, in fact, for all lighting purposes where variation in candle power is not objectionable, this method of lighting can be used. The method described, however, is impracticable where steady reading or writing is concerned.

Mr. Abadie: What is the maximum distance from the arc lamp at which you can place the incandescent lamps?

Mr. Mabbs: Fifty or 60 feet.

Mr. Kimball: Although I am not a member of your association, I might say that in Hartford, Conn., they have been making extended experiments in this line, and have adopted a special form of series lamp, giving it in the form of a bonus to customers. It is installed in stairways, entries and places of that description, and it has been very successful. I think they have it in operation now on about 50 lamps. They have been operating that number to decide whether the method is practicable, and, if so, they will put it in operation over the whole of their system.

Mr. W. F. Barker, gas commissioner of Massachusetts, was introduced by the president, and responded by explaining the condition of quasi-public corporations in New England.

Mr. Hill announced that as the steamer was late it would hardly be possible to go on shore and still keep an appointment at Sault Ste. Marie. A reception had been prepared at the latter place, and an invitation had been extended to inspect the new smelting furnaces there.

Mr. Abadie suggested that a committee of three be appointed to determine the matter, and Messrs. Mercein, Hill and Abadie were appointed as a committee.

On Monday a paper by Walter B. Snow of Boston on the subject of "Mechanical Draft" was then read by Mr. Cross, in the absence of the writer of the paper. The subject was freely discussed by Mr.

NORTHWESTERN ELECTRICAL ASSOCIATION.—DEPARTURE FROM CHICAGO ON STEAMER NORTHWEST.

Doherty of Madison and Mr. Dow of Midland. Mr. Cross also made a few remarks on the subject.

Mr. Dow of Midland, Mich., read an interesting paper on "Purification of Water."

An address by A. J. Wurts of Pittsburg on "Lightning Arresters" was another interesting feature.

This was the last meeting on the boat, and when it was concluded the convention adjourned "to the city hall at Duluth on June 14th at 10 a. m." When the convention met again the members were welcomed by the mayor of Duluth, and a response was made by President Copeland on behalf of the association. The paper by William Smith Horry on "Electric Smelting of Ores" was read by Mr. Doherty. Accompanying the paper were photographs of the rotary furnace as used for making carbide of calcium, samples of ferro-nickel 40 per cent. pure, and of iron containing seven per cent. of nickel.

The secretary announced that the following question had been put into the box: "On an overhead three-wire system of direct low-tension distribution, does it afford additional protection against lightning to ground the neutral wire at various points throughout the system?"

The president requested Mr. Wurts to give his opinion on the matter.

Mr. Wurts said: "In my judgment, the grounding of the middle wire might, and probably would, protect the generator. But I do not think that the grounding of a wire protects apparatus at any considerable distance from the point at which the wire is grounded. The self-induction of the wire, that is, the tendency of a perfectly straight wire to the passage of impulse discharges, is so great that the discharge must travel any considerable distance over the straight wire to get to a perfect ground; it will much as preference to doing that. I have seen that in practice very often and have demonstrated the fact in laboratory experiments. I have shot a current, or made a loop of wire, for instance, take a wire running from my position here to the corner of the room and back again, and place a spark gap half way between here and the corner, and disruptive discharges into the wire, and the current will pass across the spark-gap rather than go through the wire and back again. That amounts to the same thing as grounded wire, and, as I say, in preference to traveling the wire, the current will jump a considerable spark-gap."

The president asked, "What effect do you think the grounding of the neutral has on the chances of lightning entering buildings? Is it as liable to enter the house if the neutral is grounded as when it is not grounded?"

Mr. Wurts: Where will that neutral wire be grounded?

The president: Anywhere—wherever you can find a hydrant.

Mr. Wurts: If that wire is grounded as it enters the house in that neighborhood, I think it should very materially protect the apparatus in the house. What I was thinking about was, if that neutral wire was grounded at the station only, it would not protect the apparatus in the house. If you ground it at frequent intervals, I think it will protect any apparatus in its neighborhood.

The president: Do you think a dwelling is as safe from lightning with the neutral grounded as it is without?

Mr. Wurts: It is safe from disruptive discharges from that wire, but how about the other two wires? I do not think that that relieves the other two wires of the necessity for lightning arresters.

The president: Of course lightning arresters must be put on the other two wires, but I wanted to know if it was bad practice to ground the neutral wire.

Mr. Wurts: No; it is not; in reference to lightning, it is good practice, I think, and would relieve the necessity of placing lightning arresters on the neutral wire, but not of placing lightning arresters on the other two wires.

Mr. Dee: I would like to ask Mr. Wurts what his opinion is of the protection to long lines, where, we will say, barbed wire is strung on the pole above the other wires. This, I understand, has been done between Niagara Falls and Buffalo, and has no connection with lightning arresters at the station, but the barbed wire is grounded at different points along the route. At our plant we have some long lines, and we thought that possibly there might be some protection to the system generally if a similar arrangement were adopted.

Mr. Wurts: I think that overhead wire would make a very good ground wire—no question about that—but it is not my opinion that it is a valuable protection to overhead wires from lightning.

Mr. Dee: It has occurred to me that the lightning is just as apt to strike the charged wire as it is the other. I might say also that the telegraph engineers use something of this character between Buffalo and Chicago. The Western Union and Postal people put grounds on every 10 or 15 poles, with just simply the point of the iron wire going above the telegraph pole.

Mr. Wurts: I think there is a great deal of this protection needed for telegraph poles. In Illinois I have counted 10 to 20 consecutive poles struck by lightning; and that is the object of the wire running up above the pole, to protect the pole, and not the wire; and I don't know of a single case where an overhead grounded wire has been struck by a lightning discharge.

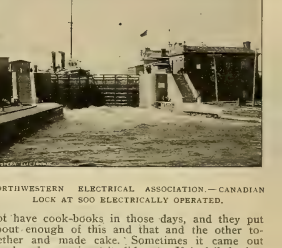
The president: Do you think that the barbed wire has any particular advantage over a plain wire?

Mr. Wurts: I think it has, if it is going to drain the charge from the atmosphere. Points, we know, drain electrical charges much more readily than smooth bodies. We know that in a static machine, if we have no points on the terminals we cannot generate pressure at all, and I have no doubt that if the overhead grounded wire is of any value, that the additional points would considerably increase its value.

Mr. Pierce: I know of a case where the wires from a dynamo were all underground, and ran down 300 or 400 feet underground. These wires were struck by lightning. The arresters were blistered, and that was the only thing that happened, which indicates that when lightning strikes wires it does not rip things all to pieces.

The secretary: This association has been honored during this trip by one of the shining lights of his profession. It gives me great pleasure to introduce Professor Elisha Gray of Highland Park, Ill.

Professor Gray: When I began my career as a so-called electrician, there was no science in electricity. We knew nothing about ohms, amperes or volts, or any of those other peculiar terms which have grown up as the science has progressed. We had to do our experimenting just about as our mothers used to make cake. You know they did

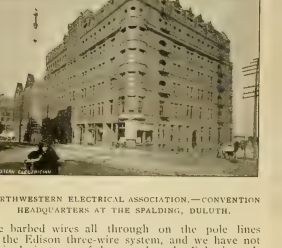


NORTHWESTERN ELECTRICAL ASSOCIATION.—CANADIAN LOCK AT SOO ELECTRICALLY OPERATED.

not have cook-books in those days, and they put about enough of this and that and the other together and made cake. Sometimes it came out good and sometimes it did not. If it failed, they did not know why it failed, and if it was a success they did not exactly know why that was either. That is about the way we had to conduct our experiments. We knew nothing about the relations of wires to magnets, resistance, etc. I remember when the first rheostat came into this country. It was a Varley rheostat with a differential galvanometer, and Charles H. Summers of Chicago, electrician of the Western Union, had the first one. He used to carry it under his arm, and he was a great man. That was the beginning of ohms in this country—the beginning of the measurement of resistances.

The secretary: The association is also fortunate in having with it one of the natives of that charming island empire, the delightful land of the chrysanthemum. It gives me great pleasure to introduce to you Professor Ichisuke Fujioka, of the Imperial University of Tokyo, Japan.

Professor Fujioka: I intended to give you a short account of what has been going on in Japan in the way of technical education, particularly electrical engineering, but I have seen so many interesting things and have got so much useful information on this trip, that the things which occupied my brain have been crowded out. I might take this opportunity to say a few words about lightning, which is the topic of this morning's meeting. We



NORTHWESTERN ELECTRICAL ASSOCIATION.—CONVENTION HEADQUARTERS AT THE SPALDING, DULUTH.

use barbed wires all through on the pole lines in the Edison three-wire system, and we have not a single instance of damage done by lightning, although our country is very often visited by thunderstorms of great energy. Thus far, many of the so-called lightning arresters have failed to give satisfaction in Japan, and I perfectly agree with Mr. Wurts as to the way in which the long-distance transmission line should be protected.

I wish to add a word regarding the feeling in Japan toward America. It is quite friendly, and, in my opinion, the development of the electrical engineering industry in general is mainly due to the efforts of American inventors and engineers. We are using Morse instruments almost exclusively on telegraph lines in Japan, and we use Western Electric switchboards on all telephone exchanges and Edison and Brush machines in lighting. That shows that the so-called alliance of the United

States, Great Britain and Japan is already accomplished, as far as we are concerned.

Resolution of Thanks.

Mr. Doherty: The convention is under obligations to many for our entertainment, and I desire to offer the following resolution, and move its adoption:

"Resolved, That in appreciation of the magnificence of the palatial floating home which has transported us from Chicago to Duluth, and the extraordinarily courteous treatment accorded us by the officers of the company, we desire to express to them our gratification and to extend to them our most sincere thanks. To anyone wishing an exceedingly pleasant trip, an elegantly appointed boat and kind, courteous gentlemen to deal with, we can gladly testify in favor of the Northwest and the officers of both the company and the boat."

The resolution was unanimously carried.

whether it was advisable to stop at Mackinac, but it was finally concluded that owing to the fact that Sault Ste. Marie had planned a special entertainment for the party and that navigation would be difficult during the remainder of the voyage, a stop of great duration would not be made. A good view of Mackinac, however, was obtained as the vessel ran into dock. A stop of a few minutes was finally made to give the delegates a glimpse of the beauties of this well-known resort. After leaving Mackinac the day was spent in contests among the ladies and gentlemen at quoits and shuffleboard. A prize had been offered by the Libbey Glass Works, to be competed for by the ladies at shuffleboard. This prize was won by Mrs. H. G. Underwood.

On approaching Sault Ste. Marie a tug came out to meet the Northwest, containing a committee from that city appointed to welcome the vessel, and amid much whistling and acclamation from the large crowd on the docks, the landing was made. The

in which he expressed the hope that he would be able to welcome the association to Japan, where he hoped it would stop on the way to some future convention to be held at Manila.

Mr. Hurst and Judge Johnson of the Canadian Sault welcomed the convention in behalf of Canada, and alluded to the present prospect of an era of good feeling between the English and American people.

President Copeland spoke for the association and Secretary Mercein read letters of regret from Mr. Edison and others.

Sunday morning the party, in charge of Mr. Clerque, was taken on board a tug to the Canadian side, visiting the locks, the immense pulpmill and Mr. Clerque's famous blockhouse, where an entertainment had been provided in the way of a luncheon. On returning the entire party was photographed on the bow of the Northwest.

Sunday night's entertainment consisted of a piano

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A vote of thanks was also extended to James R. Dee for his management of the entertainment at Hancock and Calumet. A vote of thanks was extended to the mayor of Duluth and the citizens of Duluth and Superior, and to the mayor of Superior; also to the people of Sault Ste. Marie and to the Calumet and Hecla Copper company.

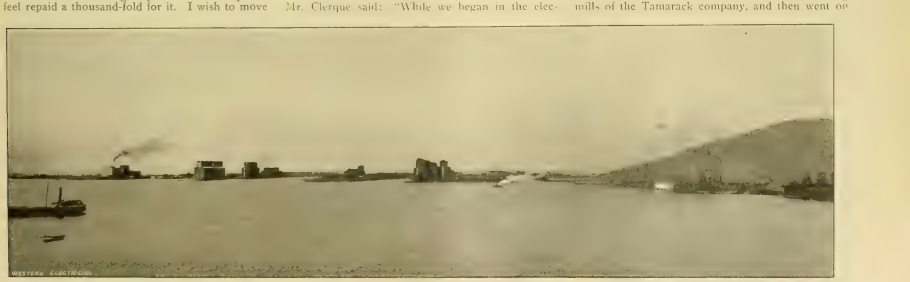
Mr. H. M. Atkinson: There is one pleasant duty that, if I am right, I think has been neglected thus far, and in getting up to make this motion. I wish to say that I heartily reiterate the words that have already been said here to-day of the pleasures of this trip. The trip from Chicago to this city will be one of the pleasantest recollections of my life, and I feel very grateful, as we all do, to the officers of this association, and I wish to say that I think the trip could have hardly been more perfect in every detail. The arrangements and accommodations on the steamer and the incidents from first to last have been most interesting and pleasant. I came a long way to take the trip and I feel repaid a thousand-fold for it. I wish to move

visitors disembarked and marched in a body through the streets of Sault Ste. Marie, passing under a magnificently illuminated arch to the Iroquois Hotel. Here the convention and its guests were welcomed by Mayor P. C. Kelliher. The address of the evening was delivered by F. H. Clerque, the most prominent and enterprising man of the Northwest, and the one to whom the association is indebted for its royal reception and entertainment at the Soo. Mr. Clerque described the resources and natural advantages of the country and some of the industries which are now developing. He said: "I have just received cable advices from Krupp's works, announcing their tests of the product of electrical furnaces in the line of ferro-nickel and nickel-steel have been satisfactory, and a contract, which I had already negotiated with them, dependent upon the samples proving satisfactory, was by cable confirmed. We are now about to put 20,000 horse power on the American side to this new use, the production of ferro-nickel and nickel-steel." In conclusion Mr. Clerque said: "While we began in the electrical industry here in the development of new electrical processes, only two or three years ago, we are already under contract to deliver 40,000 horse power for electrical uses, all to be supplied within two years. We have already developed on the Canadian side 20,000 horse power, and are about to undertake the construction of another canal on the Canadian side to produce 50,000 horse power. So, gentlemen, although we are a small community, and, as you may think, simply on the frontier, it is a fact that we have now developed and in use here more actual horse power than is under the control of any hydraulic power canal in the world. When the present contracts for power are completed the horse power furnished will exceed all the hydraulic horse power furnished in the world at the present time."

Professor Fujioka of Japan made a neat address,

solo by H. P. Goodwin, a song by Mrs. W. M. Lowry, a recitation by Thomas R. Mercein, a piano solo by Mrs. Joseph Wetzler, a comic recitation by H. G. Underwood, imitations by Frank L. Taylor, quartette by Mrs. Lowry and Messrs. Page, Knutsen and Abadie. During the intermission of the concert Mrs. Underwood christened the Libbey Glass Works prize bowl, which she had won, with some delicious claret punch, and a most enjoyable evening was ended by a number gathering around the piano, singing college songs.

Word had been passed before retiring Sunday night that all hands would be called at 6 a. m. Monday morning, in time to secure a good breakfast and board the train for the trip to the mining installations, to start at 7:30. The first stop was at the Dollar Bay Wire Works. After the party had inspected the process of the manufacture of copper wire, the trip was continued to the smelting furnaces of the Calumet and Hecla mines, and thence to the crushing mills. The train was backed to the crushing mills of the Tamarack company, and then went on



NORTHWESTERN ELECTRICAL ASSOCIATION.—VIEW BETWEEN DULUTH AND SUPERIOR FROM STEAMER NORTHWEST.

a vote of thanks to Mr. Hill and the members of his committe who have been so untiring in their efforts to add to our pleasure on this trip.

The resolution was unanimously carried, and the convention adjourned sine die.

Features of the Entertainment.

The evening of the first day out was spent in the unique manner of having the first meeting of the association in the saloon of the Northwest. It must be confessed, though, that it is a difficult matter to mix science and pleasure, and, for once, it may be said that science suffered in the contest.

During the first night out, owing to a heavy fog, considerable time was lost, and for this reason the schedule that had been planned was abandoned. The Northwest did not reach Mackinac until late in the afternoon. There was much discussion as to

to Osceola, where a brief stop was made. The special was then pushed on the Red Jacket and Calumet for the inspection of the immense mining installations of that renowned company. At Calumet the party was met by a large number of vehicles sent by the Calumet and Hecla company, and under the escort of Captain Duncan, superintendent in charge, and E. N. Bosson, the party was escorted over the properties of the Calumet and Hecla company. It would be impossible to mention in detail all the interesting sights presented in the inspection of these plants. It may be said, however, that the party visited the air compressors, shafts and the power houses, and saw what is probably the finest mining machinery plant in the world. Incidentally, it may be said that one of the shafts of

[Continued on page 360.]

Developing Power of Lower Niagara.

By Orrin E. Dunlap.

The problem of developing the power of the Falls of Niagara having been satisfactorily solved without detriment to the scenic features of the great cataract, attention is now directed to the development of the rapids of the lower Niagara. This desire to develop power on the lower river is brought about by the situation on the Canadian side of the stream. Some years ago the commissioners of Queen Victoria Niagara Falls Free Park entered into an agreement with a body of men, organized under the title of the Canadian Niagara Power company, whereby they, the commissioners, receive the sum of $25,000 per year for the exclusive privilege of developing power in the Queen Victoria Free Park. This amount of rental stands for a period of 10 years, after which time it increases $1,000 per year, until, in the 20th year, the annual rental reaches the sum of $35,000, at which price the privileges, under the agreement, may be retained by the Canadian Niagara Power company for a century from the date of the agreement. Under the franchise so obtained the Canadian Niagara Power company was to have 10,000 horse power developed by November 1, 1898, and have water connections made for 25,000 horse power, but within the year an arrangement has been made between the power company and the commissioners whereby the Canadian Niagara Power company is not forced to this feature of the agreement, but has been allowed to contract with the Niagara Falls Park and River Railway company, which company owns a wheel-pit and tunnel in the park for the development of power for the operation of its line, on the installation of certain apparatus in the railway company's station to develop power to be supplied to patrons of the Canadian Niagara Power company. It may be incidentally remarked that this arrangement is quite likely to develop all the power demanded locally on the Canadian side for some time to come, while it will also give the Canadians an opportunity to profit in the final installation of the Canadian Niagara Power company by obtaining all the latest apparatus for the development and transmission of power, built in accordance with the latest designs. While to some the extension of time thus practically granted to the Canadian Niagara Power company might appear to a way to retard the progress of the Canadian side of the river, so far as the development of Niagara power is concerned, such can hardly be accepted to be the case for various reasons. The condition of things existing on the Canadian side at Niagara Falls at present from that on the New York side is such that it was early apparent to the members of the power company, as well as to the park commissioners and government leaders, that the market for minimum blocks of power, likely to be developed by the Canadian Niagara Power company, must be found at some distance from the station or point of development. The mentioned probable markets are the city of Toronto and the city of Hamilton, the first of which is about 90 miles distant from the Falls. Toronto is very anxious to feel the impulse and thrill of the Niagara electric current, and will welcome its coming. The distance, however, from the Falls to Toronto is such that with known methods of transmission the loss is likely to be too great for profit. A week, a month or a year may change all this, and the loss may be reduced to a minimum amount. The Canadian Niagara Power company is practically the same as the Niagara Falls Power company, owner of the very successful development on the New York state side, and for this reason it has every chance of profiting by the researches of this company in the electrical field.

On the Canadian side eagerness for the development of power from some source is apparent, and, as the agreement with the Canadian Niagara Power company removes the falls from consideration, other parts of the river have therefore been given attention. The commissioners instructed Superintendent Wilson to ascertain the prospects, and he has reported that there are four or five principal points at which it would be entirely feasible to take advantage of the shore levels to develop substantial water-power plants, and, by the aid of electricity or other means of transmission, make the power available on the cliffs for commercial purposes. The conditions under which these several powers can be best developed are not at all uniform. By consulting the map it will be seen that the points of development are Nos. 1, 2, 3, 4 and 5. In plant No. 1, from the head of the rapids at A to the head of the Whirlpool Rapids eddy at B, in a distance of some 3,400 feet, there is a continuous rapid with a fall at mean water level of about 44 feet. In the development of power at this point a tunnel or conduit of large dimensions could be constructed as a head race, and the power station and machinery located at B. With a head race of 20 feet internal diameter, and with a loss of head of 14 feet in the entire length of 3,400 feet, from 22,000 to 44,000 horse power could be obtained under an available head on the water wheels of 30 feet. The estimated cost of the conduit and terminals would be about $450,000. From this point power could be furnished on the high bank for about $60 or $65 per horse power, and after allowing for all loss in machines, the amount of power available would be about 15,000 or 16,000 horse power. A larger head race would give more power at a less outlay per unit. Thus, a conduit of 24 feet internal diameter laid to the same grade would afford fully 40 per cent. more power, while the cost of the terminals, buildings, inclines, etc., would be nearly the same in either case.

Plan No. 2 would develop a comparatively small amount of power, but it would be conveniently located for consumption. It could be most readily developed by an open cutting in the rocky point separating the Whirlpool Rapids eddy from the whirlpool proper, or by a flume sunk in the talus at the water's edge. A raceway 30 feet wide and 10 feet deep would give a net capacity of 2,000 electrical horse power. As the head is small, the cost of horse power would be increased as compared with No. 1.

Plan No. 3 contemplates a development of power at the outlet from the whirlpool, and this could be done at small cost, as a moderate capital outlay per horse power would suffice to construct and equip a power of 1,500 to 2,000 horse power capacity.

While plan No. 4 is well adapted for generating water power on a large scale, it would be much more costly per unit of power developed than any of the others. The same method of development as that proposed for No. 1 might be adopted, but the greatest head obtainable would be about 13 feet, and the same description of flume would yield less than one-third the power, while the cost of terminals, buildings, etc., would be the same, and the cost of water-wheels more. There is, however, an abundance of room at this point for buildings and a fine lot of building material. The cost of construction would amount to three times as much, while not over 5,000 horse power could be obtained.

By plan No. 5 about 5,000 horse power could be developed at a probable cost of $75 per effective horse power. At this point the plant could be duplicated at any time.

In projects Nos. 1, 2 and 3 the talus would have to be cleared off and excavations made for the power houses, and in each instance access secured from the top of the bank by means of inclined planes or vertical lifts. The problems of how best to deal with floating ice and frazil would require careful consideration.

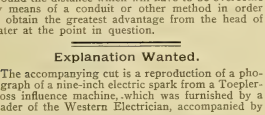
Surveys made from time to time by the United States geological and lake surveyors disclose the fact that there is a total mean difference of level between the waters of the Niagara River at the base of the Horseshoe Fall and the waters of Lake Ontario of 110 feet. Of this total about two feet is found in the navigable reach of water from Lake Ontario to Lewiston, and about 16 feet from the base of the Horseshoe Fall to the beginning of the rapids, leaving some 92 feet in the rapids above and below the Whirlpool. Those who have visited Niagara know that the inclination of the surface of the river, in the portions covered by rapids, does not present a uniform cross-section, owing to the contracted width of the stream at some points and the very broken nature of the waterway. For instance, the part of the river locally known as the Whirlpool Rapids has a grand and resistless sweep all the way from the lower steel arch bridge down to the most northerly extremity of the Whirlpool, but obstructions on either shore, in the form of great boulders, interfere with the onward flow of the water, while numerous eddies or countercurrents are formed, and the inclination of the surface of the water at the shore line is made very irregular, and at some points is much below the central elevation of the stream. Just south of the Whirlpool the shore line on the Canadian side recedes considerably, forming a long,

DEVELOPING POWER OF LOWER NIAGARA.—PLAN SHOWING COURSE OF RIVER AVAILABLE FOR WATER-POWER BELOW THE FALLS.

shallow bay, called on the map, herewith given, the "Whirlpool Rapids Eddy," in which there is a strong current flowing up-stream along the shore for the whole length of the bay. The same condition holds with reference to the Whirlpool itself, where the sweep of the current, after crossing to the north shore or the head of the pool, is deflected to the left and southwards, and flows swiftly along the Canadian shore to the southerly extremity of the Whirlpool, a distance of over half a mile. The same unusual conditions prevail at either end of Niagara Glen, and where the changes are well defined and are a permanent characteristic of the stream the difference of level between the adjacent counter-currents indicates, in each case, the head which may be obtained; and the direction of the shore eddies, above and below the rapids, defines clearly on the ground the distance which will have to be overcome by means of a conduit or other method in order to obtain the greatest advantage from the head of water at the point in question.

Explanation Wanted.

The accompanying cut is a reproduction of a photograph of a nine-inch electric spark from a Toepler-Voss influence machine, which was furnished by a reader of the Western Electrician, accompanied by



EXPLANATION WANTED.

the following comment: "Can you give an explanation of why the spark seems to have no jagged points as the sparks appears to the human eye? I have noticed especially that photographs of lightning are without the sharp points. As it is said that the camera 'sees' better than the human eye, is it probable that the actual course is not as we see it but as the camera shows it?"

Transformer Regulation.

By A. R. Everest.

The regulation drop in a transformer is a drop in voltage at the secondary terminals of the transformer when delivering current, due to internal losses in the transformer itself, the primary voltage remaining constant.

Apparently the easiest way to determine the regulation of a transformer would be by direct measurement of the voltage at the secondary terminals; first, when the transformer is carrying no load, and secondly, when the transformer is carrying full load, the difference between the two being the regulation drop, provided the primary voltage is kept constant.

In practice, however, this test is attended with a number of difficulties, so great, in fact, as to render the test perhaps the most difficult and unsatisfactory of all transformer tests. Even when the voltage on the primary side is observed by an independent voltmeter (and step-down transformer) it may frequently happen that the temperature coefficients of the two voltmeters are not alike, producing discrepancies in the readings which, in themselves

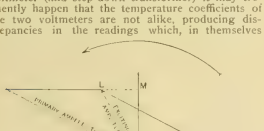


Fig. 1

TRANSFORMER REGULATION.

small, produce a large percentage error in the quantity to be finally determined.

Absolutely steady readings are also desirable for the success of this test, and this is a condition which is very seldom attained. The pulsations of a slow-speed engine reflected on the voltmeter needle are often sufficient to make the test absolutely worthless.

There are several other minor factors which tend to disturb this test. Most of them can be met independently, as by exchanging voltmeters between readings, by taking large numbers of readings at each point and averaging results, and so on; but experience continually shows that with the greatest care the results obtained by this method cannot always be relied upon.

Perhaps the hardest point of all in connection with the regulation test as commonly made is the difficulty of persuading the station electrician who makes his own tests that his results (often absurd) are open to question.

But since the losses creating the regulation drop in a transformer can be independently measured, the calculation of the regulation from these observed losses becomes a simple matter.

The regulation drop in a transformer is caused by two losses. First, the energy loss or C R drop in the transformer windings; secondly, the reactive drop or inductance of the transformer. In certain special cases we must also take into consideration the effect of the magnetizing current in the primary, since when the latter is relatively large it produces a phase displacement between the primary and secondary currents and has the same effect on regulation as an increase in the reactive drop.

When this phase displacement is so small as to be insignificant, the calculation of the drop of the transformer is reduced to the resolution of a right-angle triangle.

We desire for the base line the total energy drop, including that in the transformer and in the external circuit.

Perpendicular to this is laid off a line representing the reactive drop in the transformer—we are here assuming that the external load is non-inductive.

The hypotenuse joining these two sides of the triangle now represents the primary applied voltage. We may call this 100 per cent.

If the reactive drop is, say, three per cent., the horizontal becomes the square root of 100^2 minus 3^2, or, roughly, 99.2 per cent.

If the known C R drop in the transformer amounts to two per cent, we have left, for per cent. voltage (= 99.2 per cent. — 2.2 per cent.) at the secondary terminals, as compared with the primary input, or, in other words, there is three per cent. regulation drop in the transformer.

In many cases, however, especially when testing an unknown transformer, it is necessary to take into account the effect of magnetizing current. The calculation is then not quite so simple, but by means of the method shown below the determination can be made with the greatest accuracy. This method has the advantage of appealing directly to the eye by means of the well-known transformer diagram.

Fig. 1 shows the relative directions of secondary current, primary current and resultant magnetizing force and flux.

O L is the primary exciting current at no load. It consists of two components, O M, the true magnetizing component in phase with the flux O M, and M L, at right angles to this, which is the energy component representing the energy expended in core loss.

When the secondary circuit is closed the primary current will adjust itself in magnitude and direction so as to maintain the vector O L as resultant of primary and secondary magnetizing forces.

The magnetic flux O M generates in the transformer windings a voltage O E, 90° behind the flux in phase. This is the active voltage of the secondary circuit, and also appears as a counter electromotive force in the primary circuit, where it is shown as O I (Fig. 2).

It is here assumed that the secondary circuit is non-inductive, hence the secondary current is in phase with the induced electromotive force O E. (For simplicity we also assume that the transformer has a ratio of 1.) The voltage impressed on the primary to maintain the secondary current must be the resultant of three components (Fig. 2), I O opposing counter electromotive force 90° ahead of flux O M, I D overcoming primary C R drop in phase with primary current, R D opposing reactive drop and 90° ahead of primary current. The resultant of these is O R, which is primary impressed voltage.

It will be noted that this primary voltage O R is really the resultant of two values, R I, the primary impedance drop, and I O, the secondary induced electromotive force. If we can calculate these, and know the secondary C R we have the regulation at once.

It will be observed that any increase in magnetizing component increases the lag between primary current O P and counter electromotive force O I. Since the base line I O of primary-impedance triangle (the C R drop) must be always parallel to O P (the primary current), it follows that an increase in magnetizing component will swing the primary impedance vector I R more into phase with the secondary vector. volts I O, increasing the value of the primary impressed voltage O R for any given secondary voltage.

If the diagram is plotted on squared paper with sufficient accuracy, the regulation can be obtained at once from Fig. 2, since when O R is primary impressed voltage O I is to same scale secondary induced voltage and may be expressed in per cent. of the former. Deducting the secondary C R drop in per cent. we have the percentage of primary voltage appearing at secondary terminals. But for greater accuracy it is preferable to calculate the side of the diagram.

In Fig 3 let the vectors I D and D R be replaced by I J and J R, the vector of primary impedance I R remaining unchanged.

From the known values of primary impedance, C R and reactance, the angle (a) of the impedance triangle is known. The corresponding angle J I E = (b) of the new triangle is equal to (a) reduced by the small angle J I D. But this latter angle is the angle of lag between primary current and counter electromotive force and is readily found from the known values of exciting and full-load current. (A tabulation of the lag angle for values of exciting current from five per cent. to 20 per cent. is given further on.)

Having found the new angle (b) and knowing the value of primary impedance, the new vector J R (which we may call equivalent reactive drop) is found as the sine of the angle (b) and the vector I J (or equivalent primary C R) is cos. of same angle.

Having expressed all the values in per cent. of primary voltage for convenience, we now resolve the right-angle triangle O R J, taking O R = 100 per cent., R J = equivalent reactive drop per cent., and obtain O J, which is secondary terminal volts per cent.—secondary C R per cent.—primary equivalent C. R. per cent. Knowing the last two values, we at once have the per cent. of primary voltage appearing at secondary terminals, and therefore the regulation of the transformer.

As an illustration, the method will be applied to the determination of the regulation at full load of a transformer on which the following measurements are known. The measurements of copper loss and impedance drop are made by means of a wattmeter, the secondary of the transformer being short-circuited.

Capacity of transformer, 2,500 watts.
Ratio of transformation, 10:1.
Primary voltage, 1,000; frequency, 125 cycles.
Copper loss (C R), 50 watts.
C. R. drop two per cent.
Impedance drop, 54 volts = 5.4 per cent.
Iron loss, 60 watts.
Exciting current (no load current in primary at 1,000 volts), .125 ampere.

The lag angle of primary current behind counter electromotive force line is determined from the relative values of primary exciting current and primary full-load current. For convenience, the lag angles are tabulated below for values of exciting current from five per cent. to 20 per cent., on the assumption that the magnetizing component is 80 per cent. of the exciting current. This is sufficiently accurate for all ordinary transformers on frequencies of 50 cycles and above. The value increases, tending towards 100

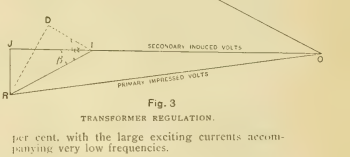


Fig. 2

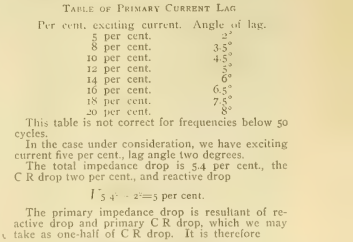


Fig. 3

TRANSFORMER REGULATION.

per cent. with the large exciting currents accompanying very low frequencies.

TABLE OF PRIMARY CURRENT LAG

Per cent. exciting current.	Angle of lag.
5 per cent.	2°
8 per cent.	3.5°
10 per cent.	4.5°
12 per cent.	5°
14 per cent.	6°
16 per cent.	6.5°
18 per cent.	7.5°
20 per cent.	8°

This table is not correct for frequencies below 50 cycles.

In the case under consideration, we have exciting current five per cent., lag angle two degrees.

The total impedance drop is 5.4 per cent., the C R drop two per cent., and reactive drop

$\sqrt{5.4^2 - 2^2} = 5$ per cent.

The primary impedance drop is resultant of reactive drop and primary C R drop, which we may take as one-half of C R drop. It is therefore

$\sqrt{5^2 + 1^2} = 5.1$ per cent.

In Fig. 2 we then have I R = 5.1 per cent.
I D = 1 per cent.
D R = 5 per cent.

To find the angle R I D we find what angle has its sine

$(R\,D) = \frac{5}{5.1} = .98$;

The angle is 79°. (See angle (a) Fig. 3.) Deducting from this the current lag angle, we have for the angle (b) 77°.

J R is the sine of this new angle and .974 × 5.1

[Continued on page 363.]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Mr. Dow's paper before the National Electric Light association on "Public Lighting in Relation to Public Ownership and Operation" was pronounced one of the ablest contributions upon this subject that has yet been presented by those who attended the discussion of this topic last week. The paper and the remark of Messrs. Atkinson and Scovil are presented in the issue.

All who attended the meeting of the Northwestern Electrical association are greatly pleased with the trip up the lake and the convention itself. It was a novel experience and it gave the members an opportunity to see a part of the country, and become acquainted with the industries of a section, in which electrical engineers are deeply interested. The great copper mining country and the water power at the Soo cannot fail to make an impression upon the history of the electrical interests of the country. Already the wonderful resources of that section are being utilized, and electricity is employed to develop and place them at the command of the world, and this is only the beginning. The excursion-convention may do much toward turning the thoughts of many toward the great advantages of the copper country.

Not content with the prominence attained through the "telectroscope," Herr Szczepanik is said to have perfected an invention that is destined to revolutionize an important branch of the textile industry. By utilizing photography and electricity he claims to be able to accomplish, in a quarter of an hour, the work of designers which heretofore has occupied months or years, according to the size of the design. By means of a photograph about four feet square the design for a Jacquard loom is reproduced with all its squares; the stencils are rendered unnecessary, and the tedious work of a year or two is accomplished in a quarter of an hour; farther, by the use of electricity the inventor sets in motion not only the punching levers, but also the threads in the loom itself, and weaves direct from the original design plate. The question has been asked: "What need of this punching machine at all if you can weave direct from the original design plate?" "It is clear," answered Herr Szczepanik, "that it would be most difficult all at once to abolish all the looms now in use, thus annihilating the great capital invested in them. Accordingly economic considerations induced me to devise a middle course, that of the stencil-punching machine, in order immediately to enable the manufacturer to produce more cheaply and to afford him an opportunity of introducing the electric looms gradually." It is said that the first public appearance of this new wonder is reserved for the Paris exhibition, where it will weave silk handkerchiefs. According to the London daily papers, which have shown great interest in the scheme, the purchaser of such a handkerchief will be photographed by an apparatus in the loom itself, the design plate will be prepared by the same machine, and then it will make a silk handkerchief with the purchaser's likeness woven into it, so that in not more than half an hour from the time when the portrait was taken the buyer will be able to take away with him as a memento of the exhibition a handkerchief with his inwoven portrait. This announcement sounds like a "quack medicine man's" advertisement, but it may be work of the London reporters instead of Herr Szczepanik.

During the present session of Congress there has been unusual interest manifested in legislation affecting the Patent Office. Numerous bills have been introduced providing for modifications in existing regulations, and many valuable measures have been proposed for the improvement of the service. When Commissioner Duell assumed charge of the office in February he found nearly 10,000 new and nearly 4,000 amended applications awaiting consideration. The new work was in date back to July, 1897, and the amended work back to September, 1897. He early directed that the old work should be brought up and kept up to within 15 days, and whenever necessary the force should remain after closing hours to accomplish this result. By this means the office has made a gain of 1,200 cases in the amended work, but the commissioner knew that this could not be kept up continually, and, accordingly, he set about to secure additional help. The Hicks bill which was passed last Monday makes ample provision for improved service, as it gives 28 additional examiners to the force of the Patent Office, distributed as follows: Four principal examiners, four first assistant examiners, four second examiners, eight third assistant and eight fourth assistant examiners. With this additional force the commissioner expects to bring up the arrears in work in the office before January 1st next, as well as to transact all new business promptly and thoroughly as applications are filed. He will also proceed to effect the classification of the United States and foreign patents, publications, etc., so that more perfect and more expeditious searches may be made. Some idea of the pressing necessity of an increase in the force of the office can be gained by considering the amount of business transacted and the clerical force and examiners at the command of the commissioner. In 1886 there were 188 examiners; there are now 200. The number of applications received in 1886 was 39,968; the number in 1897 was 47,905, or an increase in the work of about 33 per cent., to meet which the force was increased about six per cent. The commissioner was able to demonstrate to Congress that the examiners in 1897 did at least 17 per cent. more work than in 1886. The fact that the Patent Office is one of the few bureaus that may be said to be self-sustaining, was another favorable feature which helped the bill.

Opposition to the construction of trolley lines is not limited to abutting property-owners, as there is occasionally a case where some other company's line must be crossed, and then the old phrase, "When Greek meets Greek," may well be modified and modernized into something like, "When trolley line meets trolley line." The result may be imagined. In Chicago the wrecking wagon of one company was utilized in destroying the property of another, and frequently there have been vigorous controversies between the employes of rival companies, but generally these incidents have closed the controversy. Down in New Jersey, however, the courts have been appealed to, and the question raised as to whether a company's rights in its tracks and trolley system, operated in the public streets, are property rights, which cannot be interfered with against its consent, without compensation. This proposition was advanced in the case of the Consolidated Traction company against the South Orange and Maplewood Traction company, which was before the Court of Chancery of New Jersey last March. It was made clear that the construction of the crossing objected to would not only interfere with the operation of the complainant's road during the period of construction, but would also permanently change the actual condition of the complainant's property, especially by the substitution of a "frog" for a continuous unbroken rail. Furthermore, a permanent change would be effected in the method of operating its trolley wires at the point of crossing.

In the decision the court held that so far as related to the mere interruption of the operation of the first road during the period of construction, there could be no basis for compensation, for the original company's right to the use of the street was subject to the right of the public to cross its tracks located therein, and to the right of the public authorities to provide for crossing the tracks by any carriages or vehicles which have the right to use the street for travel, and to interrupt the company's operation in such reasonable manner as may be necessary to provide for the construction of the crossing, when the right to cross exists.

Concerning the second point, the decision is equally explicit. The court determines that although the crossing, as proposed, necessitated some actual interference with the tracks and wires as originally constructed, and terminated their exclusive use by the complainant at the crossing, it would not prevent the crossing by a similar railway company, without compensation, if made under the proper legislative authority. In support of this opinion it is pointed out that these changes are the necessary result of the development of the method of operating electric roads at their points of crossing, and they are therefore changes and burdens in the use of the tracks and trolley system to which the original right to lay and construct them was necessarily subject, and, in a legal point of view, continues the court, are different only in degree, and not in character, from the changes in the property and control of the tracks made in the ordinary horse-car crossing.

However, the court suggest that the company desiring to make the crossing would have no right arbitrarily to select its own time or manner of erecting the crossing, but would be bound, if no agreement were made, to give due notice both of the time and manner in which the crossing was proposed to be made. And it holds that a court of equity has jurisdiction to control the construction of a crossing, if the parties cannot agree, and that where the right to construct a crossing exists, a court of equity will, if necessary, and on application of either party, interfere to control the construction.

WAR NEWS.

Cable-cutting Expeditions.—During the last week the scene of activity on the Cuban coast changed to Guantanamo, which, like most other Cuban harbors, is long and tortuous. The town of Guantanamo is 15 miles inland, and only the little fishing village, the blockhouse and the cable station were at the entrance. The place was bombarded on June 7th, and it was found on landing that a solid shot from either the Marblehead or the Yankee had cut the wires on the side of the cable station, while another had smashed the batteries and instruments inside. This proved the most effective of any of the cable-cutting expeditions of the Americans.

It is rather singular though that it was not the intention of Admiral Sampson to destroy this cable landing, but to gain possession of it for his own use. According to a well-informed correspondent, "It is the general opinion that the landing of the marines at this place was for the purpose of establishing a suitable naval base, and it is believed that the Cape Haytien cable which leaves Cuba at this point, and which has been cut for several days, is to be repaired by Admiral Sampson at Caimanera and maintained open in order to enable ready communication to be had with Washington. The landing of the marines was undoubtedly with the object of holding this cable station. It is pointed out that direct communication with the departments at Washington will be of the greatest benefit in the cooperations of the naval and military forces, for otherwise it would be necessary to send all the way to Port Antonio or Kingston, Jamaica, or to Port au Prince or Mole St. Nicholas, Hayti, a distance of 150 to 175 miles, when it is desired to send or receive dispatches."

Further details of the work at Santiago have been furnished by Captain Phillip of the Texas, who proudly displays as a trophy "five feet of the cable which was wrenched from its resting place 400 fathoms below the surface of the Caribbean Sea." For five days the little cable steamer Adria had dragged the waters for two miles east and west of the entrance to Santiago harbor without success. On the second day the Adria clutched the cable, but in raising it one of her steam winches broke and she lost it. The work was kept up all day and as far into the night as possible. The Texas was assigned to protect the Adria from possible attacks from the shore.

On Sunday afternoon about four o'clock the Texas, which had been sent to the other end of the line, while the Adria was dragging directly opposite the harbor entrance, was returning slowly, when her lookout discovered one of the Spanish torpedo-boat destroyers creeping out from under the shadow of Morro Castle. She was headed directly for the cable ship. The Texas crowded on all steam, being then about a mile away from the Adria, and cut in between the cable ship and the torpedo-boat destroyer, which saw the battleship bearing down with her guns trained upon her, turned about and fled behind the shelter of the forts. After this the Texas stuck close to the little Adria. At six o'clock that evening the winches of the Adria began to sing, and a stentorian voice hailed the Texas, saying: "We have the cable." It took the Adria three hours to raise the cable from its deep bed. At just nine o'clock the cable was on board and cut, and the news was signaled to the fleet. The Adria cut the cable about two miles due south of Morro Castle

It is probably known to comparatively few newspaper readers that the weather reports received from the Cuban capital are an important factor in the records of the weather bureau organized by the United States government. Weather reports were received from Cuba under the international arrangement, and the plan was regarded by General Greely of the Washington signal service with great favor, as the atmospheric conditions in Cuba play an important part in the work of forecasting tidal storms. During the last decade the reports have been received every day, and the first omission in the records is now caused by the severance of the cable. The West Indian seas are looked upon as the home of the tidal storms which yearly visit the South Atlantic coast, and the visitations may not easily be forecasted for this country if the war continue and the cable service remains interrupted. A resumption of the practice of sending weather reports to this country from Cuba is not expected until Havana shall have capitulated to the American forces. If the reports had continued coming, the Washington weather bureau and the branch offices would have issued with their other forecasts daily bulletins of the weather that the American troops were having in Cuba. But when Admiral Sampson cut the last cable out of Cuba he severed a long established connection between the Cuban weather bureau in Morro Castle, Havana, and the American weather service. The naval commander's act proved more potent than war itself, for since the commencement of hostilities with Spain the weather reports from Cuba had arrived regularly from Havana every day. The temperature in Havana since the cable was cut, the degree of humidity and the precipitation, if there were any, are lost to the records of the Chicago weather office. What the declaration of war and actual hostilities were unable to interrupt the cable cutters stopped entirely. And, despite the patriotism of the forecaster, the act of naval strategy has caused him grief, for the accuracy of his data has been marred.

As usual, on the heels of the reported cutting of the last Cuban cable comes the statement from Madrid that "the minister for foreign affairs, Duke Almodovar de Rio, says there is no truth in the statement that the cable communicating with Santiago de Cuba has been cut, adding that he received dispatches from there this morning."

A press dispatch from Port au Prince, June 14th, says that "the Haytien steamer Mancel, chartered by the cable company and carrying cable and cable-repairing apparatus, left last night for Cape Haytien to re-establish cable communication between Mole St. Nicholas and Santiago de Cuba."

One of the stay-at-home patriots of the Chicago press indulges in the following comment upon efforts that have been made to interrupt cable comunication between Cuba and Madrid: "Like a good many other undertakings of the strategy board, the operation of cutting Blanco's cable communications appears to proceed somewhat slowly. We have had half a dozen cable-cutting expeditions—one of them attended with loss of life—yet Blanco continues to telegraph Madrid with as much ease and facility as though he carried a Western Union frank. As a matter of fact, the whole cable-cutting business has been bungled. The strategists deemed it necessary to go close inshore after the cables, when a regularly equipped cable steamer could have picked them up 100 miles at sea and, by cutting out a mile or two of the wire, communication would have been effectually shut off until the return of peace. It is merely owing to the obtuseness of the war board that Blanco is enabled to continue cabling accounts of glorious victories every time an excited Spanish artilleryman begins blazing away at the moon with the idea that it is a searchlight on an American man-of-war."

Recruiting Signal Company.—Captain John B. Inman, commanding the signal troops of Illinois, completed preliminary arrangements at Chicago June 13th for recruiting a signal company. Captain Inman says he expects to have the company recruited at the Springfield armory and ready to report to Washington for assignment next week. He has over 100 applications from good telegraphers who are desirous of entering the service.

Miscellaneous Notes.—Several years ago Lieutenant Fiske pointed out that the engineering branch of military service offered inducements to educated men who desired to be identified with the service. His remarks are now recalled by the announcement that the brigade of engineers, United States Volunteers, will include scientists, electrical, civil, mechanical and topographical engineers, college professors and men prominent in the commercial world. It is generally believed that Colonel Gillespie of the Corps of Engineers, U. S. A., will command the brigade, and that Captain Eugene Griffin of the General Electric company will be colonel of the first regiment, which will include William B. Parsons, chief engineer of the Rapid Transit Commission of New York; Dr. Louis Duncan, professor of electrical engineering in Johns Hopkins University; Eugene Ellicott, secretary of the University of Pennsylvania and topographical and hydrographical engineer of the United States Coast Survey and Captain G. W. Bramwell, W. G. Ramsay, F. M. Barstow, I. A. Steinmetz, Walter Abbott, general manager American Projectile company, and Lieutenants Rodman and Walke, explosive experts.

It will be of interest to the general public, hardly less than to the electrical fraternity, to know that Lieutenant Frank J. Sprague, who has for the last six weeks been confined to his house, and in great suffering, from a severe injury to his right eye, is in a fair way to recovery. Nearly two months ago a piece of the eyeglass Mr. Sprague was wearing was accidentally forced into the ball of the eye, and the sufferer had to remain for two weeks under the care of a specialist. Being very anxious to push forward to definite shape the volunteer corps of electrical engineers, which he offered some time ago to organize for early service at the front, Mr. Sprague imprudently went to Washington, where he caught cold in the injured eye. Severe complications set in, along with iritis, and for some time it was feared that blindness was inevitable. This danger, however, seems to have passed, and there is every prospect that Mr. Sprague will soon be able to renew his active part, both in the affairs of the company with which he is identified and the formation of a fighting corpse that shall fill a place of its own in the war resources of the government.

Captain Hurd, mechanical engineer for the Crane company of Chicago, has offered his services to the government and is now engaged in the preliminary work of forming a company of engineers.

The accidental explosion of an electric torpedo boat at St. Augustine, Fla., on June 10th resulted in the death of J. J. O'Rourke, an electrician, and his assistant named Houston. First Lieutenant William W. Hart, engineer officer in charge of the work of placing mines at the mouth of St. John's River, was struck in the back and head with pieces of torpedo and was injured severely. Mr. Burnham, a stenographer, and a colored man were wounded. Lieutenant Hart graduated from West Point in 1889 and is an expert in mining work. O'Rourke was foreman of the Western Union telegraph office in Jacksonville for several years.

The electrical fraternity will be interested in the controversy between Hiram S. Maxim and Hudson Maxim. The latter claims to have invented a system of throwing high explosives from ordnance at such a range that, if successful, no fleet could live against them. He has offered his invention to the American government. Some of the English newspapers have alluded to the inventor as "Mr. Maxim" only, which has brought a disclaimer from Hiram S. Maxim and a statement of opinion that the reports are "foolish, absurd and ridiculous." This has called forth a retort from Hudson Maxim, who wants to know what about that aerial machine which "Hiram" invented, and which "flew about as far as a locomotive would under the same circumstances."

Electricity seems to have played a part in the sinking of the collier Merrimac, according to the account furnished by Captain Miller, who witnessed the daring deed and was familiar with the preparations that were made for it. He said: "The Merrimac had been thoroughly stripped of valuable articles, even the clock and bell being taken off. Along one side a torpedo belt had been arranged about 10 feet below the water line, six torpedoes being placed so as to break open the compartments. These torpedoes had electrical connection with a battery on the bridge and were to be discharged by pressing a button. The man at the key was undoubtedly Lieutenant Hobson. The plan was carried out perfectly."

Transformer Regulation.

[*Continued from page 361.*]

= 4.96 per cent. Similarly, J I is the cosine of 77° and is in value $.225 \times 5.1 = 1.15$ per cent.

To determine the regulation we now resolve the right triangle R O J.

R O = 100 per cent.

R J = 4.96 per cent.

$$J\,O = \sqrt{100^2 - 4.96^2} = 99.87 \text{ per cent.}$$

Deducting J I — 1.15 per cent., we have 98.72 per cent. as secondary induced voltage (IO), and deducting again secondary C R drop one per cent., we have 97.72 per cent. of primary applied voltage appearing at the secondary terminals, or a regulation drop of 2.28 per cent.

It is of interest to note here that figuring the regulation of this transformer by the simpler method first described, entirely ignoring the effect of exciting current, the result gives 2.13 per cent. regulation drop, a difference of 0.15 per cent., due to five per cent. exciting current. With a larger reactive drop in the transformer, other losses being equal, the difference between results obtained by the two methods would be somewhat greater.

Calculated by Dr. Bedell's method, the regulation drop obtained is 2.44 per cent.—slightly higher than that by the method above. This is due to the fact that Dr. Bedell's method assumes that the magnetizing current is equal to the exciting current, which is not the case, and also in a slight degree to some other minor apptoximations adopted in the construction of his diagram.

The percentage of iron loss and exciting current taken in the above illustration are higher than would be found in good modern transformers of any but the smallest sizes, but they have been purposely taken here to illustrate the point under discussion. For the same reason the diagrams are greatly exaggerated. In actual practice the primary current line O P is very nearly parallel with the line O I.

Important Patent Legislation.

[From the Washington correspondent of the Western Electrician.]

A 10-years' fight for modern business methods in handling inventions in the Patent Office was culminated in the House of Representatives on June 6th, when Representative Hicks, chairman of the committee on patents, secured the passage of his bill for revising and perfecting the classification of letters patent and printed publications in the Patent Office. For the last 10 years the work of the Patent Office has been steadily falling in arrears, and business men and inventors throughout the country have deluged the office with complaints, but the officials were powerless to do anything, owing to the meager appropriations allowed by Congress. The bill, as passed, carries an annual appropriation of over $60,000, and provides for the employment of o additional examiners and assistant examiners. The measure has already passed the Senate, and only awaits the approval of the president to become a law.

There is a provision in the bill which will be far reaching in its effect and will work a revolution in the methods now in vogue in the Patent Office. It is to the effect that for the purpose of determining with more readiness and accuracy the novelty of inventions for which applications for letters patent are or may be filed in the Patent Office, and to prevent the issuance of letters patent for inventions which are not new, the commissioner of patents is authorized to undertake the work of revising and perfecting the classification of patents and printed publications. It has been impossible with the force at command in the office to keep pace with the increased work of examination of applications and the arrangement, perfection and classification of the sources of information necessary to determine the originality of the alleged invention.

Algona, Ia., is preparing to advertise for bids for an electric light plant.

DEVELOPMENT OF THE TELEPHONE FIELD.

Illinois Telephone Association.

The annual meeting of the Illinois Telephone association was held at Mattoon, Ill., on June 9th, and an interesting and instructive conference between representatives of the manufacturing and exchange companies took place. When the meeting was called to order by the president, Dr. I. A. Lumpkin of Mattoon, the following-named members and visitors were present:

John G. Todd, Inter-state Telephone company, Tuscola.

Miss Anna L. Wingard, Champaign-Urbana Telephone company, Champaign.

C. J. Sabin, Champaign-Urbana Telephone company, Champaign.

George Hughes, Hume Telephone company, Hume.

A. M. Howell, Montgomery County Telephone company, Hillsboro.

J. W. Gay, Mattoon Telephone company, Mattoon.

Dr. I. A. Lumpkin, Mattoon.

W. C. Lumpkin, Coles County Telephone company, Mattoon.

J. J. Downey, DuQuoin Telephone company, DuQuoin.

J. S. Cuming, Central Telephone and Electric company, St. Louis.

Henry Shafer, Stromberg-Carlson Telephone company, Chicago.

I. J. Kusel, American Electric Telephone company, Chicago.

J. J. Nate, Standard Telephone company, Madison.

D. Newman, Central Electric company, Chicago.

C. P. Platt, Western Telephone Construction company, Chicago.

A. M. Higgins, secretary Citizens' Telephone company, Terre Haute, Ind.

J. M. Coffing, Marshall Telephone company, Marshall, Ill.

E. M. Harwood, Shelby County Telephone company, Shelbyville, Ill.

W. S. Ashmore, Eastern Illinois Telephone company, Oakland, Ill.

Mr. Higgins, who was invited to address the meeting, explained the conditions at Terre Haute, where extensive operations are now under consideration. He said that the independent interests of that section desired toll-line connections with all companies whose patrons did business in Terre Haute. The Citizens' Telephone company was capitalized at $100,000, and it intended to put in a plant that would be superior to the present Bell service.

On motion of I. J. Kusel, the secretary was requested to furnish the manufacturing companies with membership blanks and lists of members, to be carried by their traveling men, in order that they might secure new members for the association. The following-named representatives kindly volunteered their services: J. J. Nate of the Standard Telephone company, I. J. Kusel of the American Electric Telephone company, D. Newman of the Central Electric company, James S. Cuming of the Central Telephone and Electric company, Henry Shafer of the Stromberg-Carlson Telephone company and C. P. Platt of the Western Telephone Construction company.

The following-named officers were elected for the ensuing year: President, Dr. I. A. Lumpkin of Mattoon; vice-president, J. J. Downey of DuQuoin; secretary, Albert M. Howell of Hillsboro; treasurer, G. W. Hughes of Hume; executive committe, Dr. I. A. Lumpkin, A. M. Howell, J. J. Downey, John G. Todd and C. J. Sabin.

The next meeting will be held at DuQuoin on Wednesday, September 7th. John G. Todd and John W. Gay were appointed a committee to arrange a programme for the meeting, including addresses from prominent telephone men and a trouble box in which may be placed any questions that any member may desire to have answered, and such entertainment as the committee may see fit.

J. J. Nate of the Standard Telephone company made an informal address, in which he reviewed a number of telephone troubles and explained the workings of the national association. The necessity of first forming local state organizations, then state associations and finally the national association, was emphasized.

The association received five new memberships during the meeting, making a total of 30 active members.

Though the attendance was not as large as the officers had hoped it would be, they feel sure that all who were present were fully repaid for the time and expense involved. They feel greatly encouraged by the enthusiasm which was shown, and hope at the meeting in September at DuQuoin to have a much more interesting and profitable gathering. It is anticipated that with the experience thus gained, the gentlemen in charge of the next meeting can procure many attractive features.

Independent Movement in Pennsylvania.

The Independent Telephone company of Lititz has an application pending before the Lancaster, Pa., City Council for a franchise to operate a telephone exchange in Lancaster county. It is the intention of the company to use the instruments of the Pennsylvania Electric company, and in order to familiarize themselves with the system prominent residents of Lancaster were invited to visit the factory of the telephone company. Accordingly two special trolley cars, having on board about 50 persons, members of City Councils, city officials and business men, left Lancaster for Marietta to visit the company's plant, where the telephones are manufactured. At Marietta the visitors were joined by a few other invited guests, and together the extensive plant of the Pennsylvania Electric company was inspected. It was found to be admirably equipped for the manufacture of telephones, with a capacity of about 250 per week, and the facilities such that the output can be largely increased when business warrants it. The visitors were well pleased with what they saw, the tests of the Pennsylvania Electric company's telephone proving it to be a very superior instrument.

How to Select a Bridged-circuit Telephone.

By H. P. Clausen.

Builders of shoddy telephone apparatus nowadays find it difficult to palm off on the exchange manager telephone and switchboard apparatus that does not comply with specifications prepared by capable men skilled in the art of telephony. The independent telephone managers are beginning to realize that in order to place their plants on a permanent paying basis, some reliable means must be adopted for enabling them to equip their systems with good substantial apparatus. Nothing demonstrates more forcibly the absolute necessity of providing a uniform method of selecting this equipment than the hopeless tangle in which toll-line systems that have been constructed at different intervals are sometimes found.

In certain sections of the country exchange managers have concluded to adopt a uniform class of apparatus for exclusive use on all interconnecting toll lines belonging to them. Furthermore, it is announced that representatives of exchanges interested in the adoption of this standard apparatus will conduct a series of tests with the telephone apparatus that may be submitted for their consideration, and determine by ballot which type shall be adopted. Such a plan would result in re-equipping many toll circuits, and would prove to be a costly experiment, if the balloting were not based on a technical knowledge of the apparatus under consideration.

What manner of test should be made and what information should be given the manufacturer when called upon to furnish instruments for such a test are important questions that should receive careful attention.

As a first consideration we will ascertain in what respects a bridged telephone differs from the instruments employed for series work. The transmitters, the receivers and induction coil we find to be alike; therefore we have only the signaling apparatus to compare. Selecting two complete telephones, one arranged for bridging and another for series work, we find it a difficult matter to tell which is which; of course, an examination of the wiring in the respective instruments would serve as a guide. However, remove the generator and ringer from their support, mix them up, so to speak, and it will be found that the instruments cannot be identified by their outward appearance. In what respects, then, do the instruments differ? Selecting at random one of the magneto ringers, let us remove the electromagnets and make a somewhat closer examination. Then we may proceed to dissect all of the remaining instruments in a like manner, and, after tabulating the results of our investigation, we will readily perceive that there is a vast difference in them and that they were each wound for a different class of service. Referring to the table given below, it will be observed that the samples A and B represent magneto ringers and that C and D represent magneto-generator armatures.

	Kind of instruments.	R—Ohms	Size of wire.	Number of turns.
A	Magneto ringer..........	80	No. 30 B & S	4,600
B	Magneto ringer..........	1,000	No. 36 B & S	12,960
C	Generator armature....	275	No. 32 B & S	3,900
D	Generator armature.....	500	No. 34 B & S	4,500

Though the figures given in the foregoing table furnish enough evidence to enable one to identify the various pieces of apparatus, it may be mentioned that the series ringer is wound for 80 ohms resistance mainly on account of the retarding influence it exerts on the voice currents, which in a series system must necessarily pass through every ringer magnet in the circuit.

The 1,000-ohm ringer is intended to accomplish an object just the reverse of that of the series ringer, namely, to provide such a large resistance as to present an almost effectual bar against the passage of any voice currents. Moreover, the bridge ringer needs to be much more sensitive than the series ringer, and this result is obtained by the increased number of turns of wire on the ringer electromagnets.

Sample C is a magneto-generator armature wound to a resistance of 275 ohms. It is obviously intended for the bridged telephone line, as such circuits always require the largest possible quantity of current that can be produced by a given generator, delivering the current at a sufficiently high electromotive force.

The magneto-generator armature D, wound to 500 ohms resistance, is employed for series work. As a rule it is required to give but a very small amount of current, but the electromotive force produced by it must be comparatively high. Practically speaking, the series toll circuit offers much better facilities for ringing over long lines than the bridged circuit, but the advantages in favor of the bridged system, as regards the talking service, more than offsets the advantages gained in the calling service on a series line.

Nothing need be said regarding the requirements of a bridged-circuit telephone, excepting that if we have a given circuit and a fixed number of instruments connected thereto it is a poor manufacturer indeed who cannot furnish the requisite apparatus for rendering a satisfactory service. It is of course the signaling apparatus that requires to be particularly well made, and when employed for unusually long circuits the problem becomes more difficult. But even then it is merely a question of volts and amperes, for with a given instrument we know just how much current it is necessary to force through the windings of the electro-magnets to produce the desired results.

On long-distance lines, where the line resistance becomes an important factor, it is more difficult to supply the proper apparatus. The magneto generator must be wound so as to generate a sufficiently high electromotive force for forcing the required amount of current through the magneto ringer located farthest away from a signaling station. Therefore, in making a test the different instruments should be compared under exactly similar conditions, and what is more important, the conditions imposed should be as nearly identical with the conditions that it will meet on the actual toll-line circuit as can be secured. When the manufacturer is called upon to furnish instruments designed for bridged toll-line service, he certainly is entitled to such information as to how and under what conditions the instrument submitted will be compared with the instrument furnished by his competitors.

The testing and selecting of telephone instruments for a simple toll circuit is unimportant compared with the difficulties met with when it is necessary to select all the apparatus that will have to be provided in changing over from one type to another where toll-line apparatus is distributed over a large section of country. It is undoubtedly true that almost any type of instrument will give far better service when the equipment is uniform throughout than when different types are employed. It must be admitted that balloting by a score of exchange members can scarcely be accepted as an ideal system, and it cannot be expected to produce results equal in value to the adoption of a report by a committee of technical men after making a thorough investigation of all conditions that would be met.

Independent Telephone Association.

The Independent Telephone association will hold its annual meeting in Chicago June 30th. The sessions of the convention will occupy three days, and it is believed that there will be a large attendance. The Palmer House will be the headquarters of the organization during the convention, and the meetings will be held there.

The time and place of the meeting have just been decided by the advisory board, consisting of James M. Thomas, Chillicothe, O.; William J. Vesey, Fort Wayne, Ind.; H. D. Critchfield, Mount Vernon, O.; C. R. Savidge, Sunbury, Pa.; J. C. Duncan, Knoxville, Tenn.; S. G. Higgins, Saginaw, Mich.; Hugh Dougherty, Bluffton, Ind.; Thomas R. Marshall, Keithsburg, Ill., and Edgar L. Miller, Frederick City, Md.

The officers of the association are: President, James M. Thomas, Chillicothe, O.; first vice-president, H. C. Young, Columbia, Pa.; second vice-president, L. K. Hime, Oskaloosa, Ia.; third vice-president, Thomas Fricker, Ashtabula, O.; secretary, W. J. Vesey, Fort Wayne, Ind.; first assistant secretary, G. W. Beers, Fort Wayne, Ind.; second assistant secretary, D. C. Dow, Cobleskill, N. Y.; treasurer, L. A. Carr, Durham, N. C.

Judge Thomas says that the proceedings will be confined strictly to the business of the organization and that the meetings will be open to members only. All independent telephone men are entitled to membership in the association upon meeting the requirements.

Pretty Telephone Girls.

There is a little telephone girl in Brooklyn who will do well to look to her business affairs if she does not wish to close them up with some celerity, according to an eastern contemporary. A telephone girl requires some other attributes than beauty; in fact, beauty may be a decided detriment to business. A business man in a hurry, as business men usually are, went in into a pay station the other day over in the eastern district to telephone. He gave his number and then he waited, not very long, but long enough to annoy him, and he rung up, to be answered after awhile that the line he wished to use was engaged. Each time he rung he received, after

awhile, an answer, but no information was volunteered. He was angry.

"I have telephoned from all parts of the city," he said to the proprietor of the pay station, "and I never have had such bad service before."

"Yes, it has been bad lately," said the proprietor. "The agent was in not long ago and wanted to know how the service was. The girl on this line, he said, was very pretty and attractive and had many admirers, and he had to look out for her. The service had been all right, and I told him so, but I shall have to give another report next time."

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone company has constructed a telephone line from Elma, Ia., to Deerfield and Charles City.

Work is to be begun at once on the line of the Rocky Mountain Bell Telephone company from Missoula, Mont., to Wallace, Idaho. The people of Coloma and Garnet want to get connection with Bearmouth, and offer a $500 bonus toward the construction of the line.

The Mankato Citizens' Telephone company has been granted a franchise for a telephone exchange in Mankato, Minn., and will begin work at once.

The Minnesota Central Telephone company has made slight reductions in its long-distance tolls.

A survey is being made for a telephone line from Spring Green, Wis., to Dodgeville.

The Central Minnesota Telephone company is working toward Minneapolis from Litchfield, Minn.

The council of Duluth, Minn., has given the Board of Public Works power to remove all telephone and telegraph poles in the city that are not in use, on condition that 30 days' notice is given to the owners and three weeks' notice by publication.

A telephone company has been incorporated to connect Shelly, Minn., via Caledonia, N. D., with the Edmonds and Hurley farms and Hillsboro, N. D. The line is to be put in operation at an early date. Its title is the Hillsboro, Duane, Caledonia and Shelly Telephone company.

The Mississippi Valley Telephone company has begun setting poles in Muscatine, Ia.

The telephone line from Mount Ayr, Ia., to Watterson, Ringgold, Caledonia and Hatfield, Ia., is completed.

Dr. Stewart of Chariton, Ia., is negotiating with the Mutual Telephone company of Indianola, Ia., to build a line to connect with the Chariton line at Lacona.

Arrangements have been completed by which L. S. Taintor of Menomonie, Wis., has bought the interest of James E. Keelyn in the Eau Claire Telephone company and the Chippewa Falls Telephone company and satisfied the claims against those companies held by Messrs. Heafield and Hills. The latter recently brought suit and attached the exchanges.

The Western Electric Telephone company is building a telephone line from Mankato, Minn., to St. Peter.

The Eastern Wisconsin Telephone company has been granted a franchise at Fond du Lac, Wis.

A Duluth, Minn., party contemplates extending a long-distant line to Two Harbors, Minn.

The E. H. Martin Telephone company of Webster City, Ia., has ordered a new switchboard of improved pattern.

The Northwestern Telephone Manufacturing company of Milwaukee has been granted a franchise for an exchange at Albia, Ia., subject, however, to the approval of the voters at the next election.

The Mutual Telephone company will connect with North Branch, Ia.

A local telephone exchange is proposed at Lisbon, N. D. The citizens are dissatisfied with the Forman Telephone company.

The People's Telephone company is putting in a toll line between Plattsburg, Ia., and Lathrop.

Work has been begun on the new telephone exchange at Centerville, Ia., and it is expected to have the system in operation by August 1st.

The Hilger-Fergus telephone from Lewistown, Mont., to a number of ranches is completed and in operation.

The Iowa Telephone company has been granted a franchise at Dysart, Ia., conditional on the people ratifying it.

A new telephone exchange is projected at Le Mars, Ia. A large number of subscribers have been secured.

The council of Des Moines, Ia., has passed a resolution forbidding the Iowa Telephone company (Bell) to use poles in the city, because it has no franchise. The city solicitor was instructed to commence a suit against the corporation if the resolution is not complied with. The council wants lower rates and takes this means of getting them.

The moving of a large building in Oshkosh, Wis., brought grief and trouble to the Northwestern Telephone company and the Citizens' Traction company recently. The building was too high to pass under the telephone and trolley wires, and they were lowered. In moving the building a pole was broken and the wires broke and became entangled, and the result was to cut off the South Side from telephone service and interfere with street-car traffic.

The Minnesota and Dakota Telephone company has been incorporated at Aberdeen, S. D., with a capital stock of $50,000. The Dakota Central Telephone company and the Minnesota Central Telephone company are both interested in the new company.

English Telephone News.

The telephone question is occupying a good deal of attention in England nowadays. There has been published in pursuance of the order of the House of Commons a copy of the agreements entered into on March 25 and 26, 1896, between the postmaster-general and the National Telephone company for the transfer of the trunk lines. The features of the greatest interest will probably be the exchange or "terminal" charges provided for where a telephonic message is transmitted over the trunk wires between an exchange of the National company and an exchange of the Postoffice or some licensee other than the National company, and another clause, which says that the agreement shall not prejudice or affect the right of the postmaster-general to establish telephonic communication himself or license others to do so. The abstracts show that the transfer of lines amounted to nearly 30,000 miles of wire, and when to these are added the lines built by the Postoffice, it will be seen how important a branch of the Telegraph Department the trunk telephone lines have become.

As a result of the agitation of the telephone question in Great Britain, a Parliamentary telephone inquiry has been ordered in the House of Commons, and a select committee appointed to "inquire and report whether the telephone service is or is calculated to become of such general benefit as to justify its being undertaken by municipal and other local authorities, regard being had to local finance, and, if so, whether such local authorities should have power to undertake such service in the districts of other local authorities outside the area of their own jurisdiction, but comprised wholly or partially in the same telephone area, and what powers, duties and obligations ought to be conferred or imposed upon such local authorities." The evidence taken before the select committee on the telephone service in the session of 1895 and the report of the commissioner and the evidence taken before him in the inquiry recently held at Glasgow are referred to the committee for consideration in so far as they relate to the subject of the present inquiry. The committee consists of 17 members, and is authorized "to send for persons, papers and records." Sir James Ferguson, a director of the National Telephone company, had been originally proposed as a member of the committee, but he preferred not to serve.

At the first meeting of the committee Sir Robert Hunter, solicitor to the Postoffice, was called, and the chairman inquired what was the position of the postmaster-general as to the telephones, first with regard to the public, and secondly as to the licensees? In reply, the witness related the proceedings of the government in the early days of telephony leading up to the litigation against the Edison Telephone company, in which a decision was given which bound both of the companies then in the field. Immediately after that decision was given the expediency of granting licenses was considered, and the government decided, in preference to buying up the whole of the patents and taking into their own hands the whole system of communication, to grant licenses. The postmaster-general accordingly granted licenses. No monopoly was granted, and no special way leave was granted to the companies. Until 1892 there had been several competing companies in the field, having no limitation on their rights as the gas and water companies had, and able to regulate their own charges, but in that year the two then existing companies—the National Telephone company and the New company—came to an arrangement by which it was provided that the government should take into its own keeping the trunk lines of communication, leaving the telephonic exchanges in the hands of the company. The National Telephone company had a right to carry on communications with any urban district. Then the question arose of areas, or tracts of country lying more or less in connection with urban districts. The area of London was 20 miles square, or 400 square miles. If a telephone company were guilty of systematic or intentional delay in forwarding communications it would be a breach of agreement with the Postoffice.

It was denied that the Postoffice had connived at the amalgamation of the two companies. It might have known what was happening, but it did not assist in it, and had no power to prevent it.

The witness expressed the opinion that local authorities could not spend money on a telephone system without a special act of Parliament. There was no doubt that if they had such an act there would be nothing to prevent them from working in the same area as the National Telephone company. He thought that the National Telephone company might refuse to connect with the local system. They could not refuse to transmit a message from, say, London to a provincial town, because that would go over a trunk wire, and it would be contrary to the agreement with the Postoffice to refuse such a message. The Postoffice had always told the National company and every other telephone company that the Postoffice was free to give competing licenses.

It was further developed that the Postoffice had taken legal opinion as to whether a telephone service could be established by a municipality which did not use the ratepayers' money. It had been decided in Scotland that what was called the "common good" could not be used for this purpose. It was not known whether the corporation of London or any other corporation which possessed funds which were not in the nature of a trust could establish such a system.

It is proposed to hold a conference of representatives of local authorities on the subject of the telephone system, in view of the appointment of a select committee of the House of Commons to inquire whether the telephone service should be undertaken by municipal and other local bodies. The local authorities of London have been invited to appoint representatives to attend at the investigation and to confer with the select committee as to the needs of London in the matter of the telephone service.

The London County Council and the National Telephone company seem to have considerable difficulty in reaching an understanding. Pending the report of the government select committee on telephony, the highways committee of the council recently expressed the opinion that it would not be well for the council to proceed further with reference to the proposed agreement with the National Telephone company in regard to the conditions under which permission had been given in certain cases for the placing of telephone cables underground. The committee thought, however, that as under the conditional consents the company had executed certain works the company should be required to enter into an agreement embodying certain conditions in regard to the works already carried out. The committee, therefore, recommended that the telephone company should be requested to enter into an agreement undertaking (1) to alter any telephone line if and when required by the council, and (2) that if and whenever the council desired to adopt electric traction on any tramway belonging to or leased by or under the control of the council, which passes along any street or part of a street in which any line of the company is laid, the council may require the company to alter any such line, or portion of such line, or to remove the same to such position as the council may require, and thereupon the company shall, without any claim for compensation against the council or its lessees, proceed to make such alteration in the position of such line; as no earth return but a complete metallic circuit is provided and used, the council or its lessees shall not be liable to the company for any interference with, or prejudicial effects produced upon, the cables or wires or the working of the same, or upon the operations of the company, by reason of such use of electricity upon such tramway. This subject will probably afford matter for discussion for several months.

Telephony in Switzerland.

In Switzerland the government controls the telephone, this branch of the public service being a part of the Telegraph Department. The Berne exchange has 2,025 subscribers, the average length of wire per subscriber being computed at 1,093 yards. Originally the subscripton was fixed at £4 16s. for the first year, £4 for the second, and £3 4s. for the third and succeeding years, these sums entitling the subscriber to 800 communications annually, but the subscription has been lowered to £1, £2 16s. and £1 12s., with an additional charge of ½d. for each communication, whether day, night or Sunday, so long as communication is required only between stations having a permanent service. Communications for other stations are taxed at 2½d. per communication; and between the hours of 2 and 5 a. m. 5d. per communication. The charge made for supplying and working subscribers' instruments is £4.

It is remarked by an English contemporary that telephone subscribers in Great Britain would look upon this as a somewhat complicated and troublesome system, and might even prefer the more expensive but less involved British method. The Englishman prefers to know the gross amount he is liable for in connection with his business arrangements. The same comment is applicable to this country.

The wages of the ordinary workmen engaged in connection with the telephone service range from 3s. to 3s. 6d. a day of 10 hours; the skilled workmen from 5s. to 5s. 6d., Sunday work extra, with fairly liberal provision in case of accident, illness and death. Women are employed as operators in preference to men, and receive a salary of from £48 to £72 per annum for a working day of seven to eight hours in winter and eight to nine hours in summer, with extra for night duty. Each operator attends to from 100 to 120 subscribers, and controls five inter-town trunk lines.

New Denver Exchange.

The remarkable increase in the telephone business of the residence district in the city of Denver, has made it necessary for the Colorado Telephone company to build a sub-station at the corner of York street and Colfax avenue. The one-story and basement structure will be completed by July 1st, and will have a capacity of 2,100 subscribers, but at the outset probably not over 250 instruments will be connected to the exchange. The sub-station is located about two miles from the company's building on Lawrence street, and the two exchanges will be connected by trunk lines.

Public Lighting in Relation to Public Ownership and Operation.[1]

By Alex Dow.

This paper is written to set before the association a proposed policy. It is not a new policy in its parts, neither is it an untried policy. It is applicable immediately to public lighting; that is to say, to the lighting of streets and public places under contract with, or on account of, a municipality. Ultimately its application may be more extensive.

It is the belief of many members that the National Electric Light association should formulate and publish a well-considered method of dealing with this business. While local conditions differ, there is no local difference in the principles which should govern electric-lighting companies in their dealings with municipalities and municipalities in their dealings with electric-lighting companies. An authoritative statement of these principles is needed. A statement by the association may be accepted in the first place only by the electric-lighting companies, but if the principles so stated are intrinsically correct, their acceptance by the municipalities must follow. No city government will persist in a course that is plainly inequitable. City governments have in certain cases acted inequitably in the matter of public lighting, but their action has not been plainly inequitable. In such cases principles have been obscured by details or by personalities, or have not been distinctly understood by the parties on both sides of the case. The public does not seek to be served at the expense of the individual. Public opinion may at times be biased, but it intends and endeavors to be just. And under our scheme of government public opinion is the final authority; and an appeal to public opinion is the ultimate means of redress for any grievance.

The advocates of municipal ownership have long recognized the value of public opinion and have presented their case both to the people of the country at large and to the citizens of selected municipalities through magazine articles, newspaper discussions, and addresses to public gatherings. Some of our members have met these arguments in kind and have confuted extravagant statements by the presentation of facts. But the man who is plainly arguing in his own interest is handicapped in a debate before a non-judicial tribunal as against those who claim to be disinterested. And it is not to be denied that the arguments which have had most influence on public opinion in this matter are those of theorists who certainly believe that they are doing the world a service, who are usually misinformed, always impracticable, but thoroughly in earnest.

A declaration of principles by this association and the recommendation to its members of a policy based on those principles would have greater weight with the public than the statements of individual companies, and would be accepted as authoritative over a wider area. But even if not accepted by the public its immediate acceptance by our own members will be useful. That each member must act for himself is a consequence of the conditions of our business, but that all should act on similar lines is possible and is desirable. Each of us looks to other cities than his own for light on problems which are new to him. Each of us, by a successful solution of any problem, benefits the industry at large, and, on the other hand, he who fails to appreciate and to properly deal with such a problem as this, injures, by his failure, not only himself, but all of us. Therefore it is well that we should agree on general principles and that we should advise with one another on special cases.

Let me make this general statement more specific. The member of this association who by good service, by close figuring of expenses and of profits, and by clear statements and logical arguments, convinces the authorities of his own city that it is to their interest to leave their public lighting in his care, has done all of us a service. The member who, on the other hand, fails to recognize the drift of opinion among his fellow citizens, who tries to convince them that unsteady and uncertain lights are worth a high price, who depends for the retention of his city-lighting contract on an appeal to the technicalities of his state law, or to the pockets of the venal members of his local board of aldermen, and who thereby brings about the erection of a municipally owned electric lighting plant and the publication of the bare running costs of that plant in parallel columns to the prices which he wished to charge—the member who does these things which he ought not to do, and leaves undone those other things which he ought to have done, is a detriment to the industry throughout the entire union.

I have indicated why I believe a declaration of principles and of policy is desirable. The principles to be declared will need little discussion, but the policy which to me appears best, may, when examined by others, appear to require amendment, or even radical change. It is offered to you for consideration in the belief that it is logical and that it is practical; but as a proposition for discussion and amendment, rather than as a perfected plan.

A Chapter of Electric Light History.

In the history of street lighting by electricity no chapter contains more profitable matter for study or for illustration of general principles than that which contains the record of the city of Detroit. That city was one of the first to use electric lights on its streets. It began in 1883 with 22 arcs, and in 1884 abandoned all other street lights. This street-lighting business was believed by those who first engaged in it to be a monopoly secured by patent rights; they found their mistake after much money had been invested under that belief; competition ensued; then consolidation, and finally municipalization of the service. I shall find it convenient to refer to Detroit for more than one modern instance.

In February, 1896, the city of Detroit owned 1,500 arc lamps and was operating 1,492 of these in the work of street lighting. In the same month the successor of the Brush Electric Light company, which installed the original 22 lamps in 1883, and which, until 1890, lighted the streets under contract, owned 1,049 arc lamps, and used in private lighting 433 of that number. Another company, organized in 1890 to compete with the Brush Electric Light company, owned 1,330 arc lamps and was using in private lighting 38 of these. In each case there accompanied the arc lamps a sufficient number of dynamos, engines, boilers, etc., and a building fully equipped for the operation of the number of lamps stated. At the same time the city had in use 134 towers, which had been formerly owned by the Brush company, and the other company was in the act of taking down and removing from the streets 104 similar towers, which had formed a duplicate of the Brush company's equipment. The necessary lines to connect lamps distributed over a large city had been owned by all three. The city had in use 329 miles of overhead wires, connecting to its 1,492 lamps. Neither of the companies had owned such a great mileage of line, but one had taken down lines and poles which had supplied 719 lamps, and the other was in the act of removing lines and poles which had connected 1,729 lamps.

Some of the Brush company's street-lighting equipment had been during the preceding five years diverted to the supply of commercial lights. Nevertheless, two-thirds of the equipment is to the present day a useless asset. Lamps which were bought at $40 have proved impossible of sale at one-tenth of the price. Dynamos which cost $2,400 cannot be sold to-day for $240. Lines taken down returned only a small percentage of their cost to the treasury. The towers which this company sold to the city did not bring their original price—that goes without saying—but they brought a fair price.

The loss of the second company was greater. Changes in the business had made their street-lighting arc lamps unavailable for commercial use, or almost entirely so. Similar changes had made their dynamos a slow asset. The engines were partially diverted into commercial service and the boilers entirely so. The wire taken down was not of a size that would fit in to their commercial-lighting system and the poles hardly paid for the labor required for their removal. The 104 towers—one of the heaviest of all the original expenses—had to be sold as scrap iron.

Destruction of Values.

It is clear that a loss to some person or persons was involved in condition which reduced machinery and lines capable of supplying 2,000 arc lamps to approximately their junk value. Leaving out all questions as to personal fault—neither affirming nor denying that the loss fell upon those for whose economic blunders it was the inevitable punishment—it is certain that there was a loss to the community at large; that property which might have been and which had been capable of doing good service to the public, was as surely destroyed as if it had been swept out of existence in a great fire.

It may be asked on whom did the loss fall? In social economy the loss of one is the loss of all, but to our customary modes of thought there appears a difference between losses borne by ourselves immediately and those which are apparently borne by other people. In this case the greater part of the loss was borne by business men of the city of Detroit. It was a reduction of the available capital of men engaged in productive industry in the city. This reduction—this absolute loss—after correcting for inflated values which should have been written off long before the period of liquidation; after correcting for securities issued for cash at less than their face value, or for considerations which were valued at more than their true worth, was not much less than $400,000.

I do not ask you to sympathize with the immediate losers, but I ask you to remember as my argument proceeds that this loss came about in consequence of business methods and of social tendencies which are in active operation to-day in nearly every town represented in this association. And I submit as a principle not admitting of dispute, that the duplication of an effective equipment for public lighting is an economic error, entailing loss of available capital to the extent of the duplication.

Improper Competition.

The first error in Detroit was the offer to the city of competition for the public-lighting contract. The men who made the offer knew perfectly that their success would mean a heavy loss to the original contractors, but they were willing to make a profit through other people's losses. In this they disregarded a principle much older than the electric-lighting business, that which calls on us to do to others as we would that others should do to us. Some of these men doubtless thought that they were doing the city a service by providing competition, but the managers of the manufacturing concern which was the majority stockholder and chief promoter in the new organization had no such excuse. Their object was to sell machinery. I do not ask you to condemn these people now. They have reaped as they sowed, and the exploitation of competing lighting companies by manufacturing concerns is a thing of the past, although its consequences in the shape of inflated capital are likely to be a burden for years to come.

I submit as a direct application of the principle last stated, that competition for public-lighting contracts, for the execution of which there is already an effective equipment in existence, is not legitimate business. The corollary of this statement is that the price at which public lighting is to be performed must be determined by some acceptable means other than competitive bidding. In this there is a departure from the established method of municipalities, which now depend on competition for the setting of prices on all public services performed by contract.

Wanted: A Substitute For Competition.

In the absence of some other acceptable means of setting a proper price for public lighting by contract, public opinion will not tolerate the suppression of competition. A reference to Detroit illustrates this very well. When the second company had, by making a lower price and by meeting the demand of the public for the undergrounding of wires in the business district, secured a three-year contract for public lighting, its managers found themselves in a precarious position. It was apparent that at the term of the contract they would again have to reduce prices to meet the competition of the original contractor, who could not afford to have his plant standing idle. It was also immediately apparent that the idle plant would be, as far as possible, diverted into private-lighting work and would there also tend to reduce prices and to divide the available business. Legal questions as to patent rights added to the difficulty of the situation. An attempt to combine the two interests was plainly necessary, and it was made; but the inevitable personal soreness prevented a combination until the new company had completely duplicated the equipment of the old one.

Of course the public became advised of the cessation of competition, and the advocates of municipal ownership made the most of the facts and added much fiction. Long before the contract had expired it was plain to any careful observer that it could not be renewed at anything like the former figure, and that the tendency of public opinion was strongly to municipal ownership. It was a period of "reform"—I use the word in its political sense—one of those periods when the taxpayers, usually content to be bossed unquestioningly by the practical politicians insist on calling the particular bosses of the hour to an accounting and expect to find that they are rascals. And as the public's way of having an accounting is to discharge its servant first and take up the reckoning afterward, the public servants of such periods are quick to fall in with the drift of public opinion in order to show that they either do not deserve discharge or are fully justifying their appointment to their new situations. Politicians are wise at such times; lighting companies sometimes are very foolish.

So the cry went up that there was no such thing as competition in the lighting business; that the men engaged in that business all intended to rob the public, and that if they appeared at times to compete with one another, it was only a temporary falling out among rogues. And the public being told on the one hand that all existing lighting companies were composed of rascals, and on the other that all municipally owned plants were successes, made up its mind that its only salvation lay in municipal ownership.

You can see, and any careful student can see, that the suppression of competition was inevitable, because its continuation meant a cumulative loss to those engaged in it. Possibly the public might have been made to see this, although the time to have begun work on the public was before the first loss due to competition had been incurred. But to merely prove that competition was impossible would not have been enough. It must further be proved that competition was unnecessary, and the only way to do that was to offer good service at an acceptable price. Under the circumstances the price might have to be very low indeed, for the belief was abroad that the business was enormously profitable at the established rates. The figures sent forth by certain municipal plants were quoted as warranting this belief, but these could have been contradicted. It was possible to send to Bay City and to Topeka a competent engineer—say one of the professors of the University of Michigan—whose dictum would be accepted by the newspapers and their readers; and so obtain the true figures. It was possible to answer in a similar manner the argument based on the competing bid at the last letting of the contract. That argument was that any business which justified the erection of a complete manufacturing plant on the security of a three-year contract must be exceedingly profitable. The contract price was a good one, but it would not pay for the plant in three years, as the public of Detroit thought it would. A showing of the whole truth as to costs, certified by a recognized authority, and followed by a bid carrying a minimum profit, might

1. Read before the National Electric Light Association at Chicago, June 7, 1898.

have been accepted by the public as a substitute for competition.

Collision with Public Opinion.

And here was made the second great error of the electric-light companies. Their managers seem to have been the only people who did not see what was coming. They failed to keep in touch with their public. The public was absorbing all the fool figures that the wildest theorists could furnish, but never a figure deserving credence was offered in contradiction.* The public was damning the poor quality of the lights then furnished and was told that it did not know a good light when it saw it. The public was determined to have much cheaper lighting, yet when bids were asked for they were almost as far above a possible figure as the costs published by the theorists were below it. The only hope for the contractors was to secure the support of the more conservative elements by offering good light at a minimum rate. On their failure to do this, and to do it quickly and gracefully, municipal ownership was as certain as the coming of summer.

Some effort was made by the companies in the Legislature of the state and in the City Council to protect their interests, but these bodies, especially in a reform year, cannot be expected to go counter to a strong public sentiment. In this they are wise in their generation.

Would the public of Detroit, after the agitation for municipal ownership had become general, have approved of award of contract at a low price, or would it have insisted on municipal ownership as a matter of principle?

An answer to this is merely an expression of opinion, but I believe that had a low price been offered the agitation for municipal ownership would have been suspended and that the companies might have secured terms more to their interest than was the action actually taken. There were many people in Detroit who did not wish to see the experiment of municipal ownership tried, except as a last resort. There were a few people who believed in municipal ownership as a matter of principle. There were doubtless also a few who expected to reap a personal benefit from the establishment of the city plant. Nevertheless, the great majority of the citizens sought only to reduce the expense and to improve the quality of the public lighting, and cared nothing for city ownership, except as a means of reaching a desired end.

In other lake cities where the agitation was fully as strong, concessions on the part of the lighting company led to a continuation of the contract system. The case of Toronto is a notable one, because the municipal sentiment is exceptionally well developed there. The local company is now performing lighting for the city at a figure a trifle less than was estimated as the cost of operation of a city plant. At Cleveland the local company holds the business because it made a price so near to actual cost that there could be no possible saving in municipal ownership, and the price was accepted after a careful inquiry into costs in neighboring cities on behalf of the municipality. The recent case of Tonawanda is another instance of success won on the same lines. There the local company submitted figures made by a recognized authority, showing the actual costs of operation in several representative municipal plants, and followed these figures by a bid more favorable to the city than municipal operation. I am assured that in each of these cities, while the contract figures are low, the management of the local company considers the business ultimately, if not directly, profitable.

Reason for Public Lighting by Contract.

In these instances the local companies have retained their public-lighting business by demonstrating that it was to the interest of the municipality to let them retain it. In this they have put into successful practice the most important part of the policy which I advocate. I submit that the only sufficient reason why a municipality should contract with a private company for public lighting is that the private company can do the work, and is willing to do it, cheaper than the municipality can itself do it by the direct operation of a public-lighting plant. It is in order to show how this comes about.

Difference Between Public and Private Lighting.

There is no longer any question of the right of a municipality to own and operate its own public-lighting plant. Electric street lighting is a distinctly public service, which must be provided for by the municipality. It is a service to every citizen; is a sequence of the social conditions which constitute city life as distinguished from rural life, and can only be effectively performed on municipal account and under municipal control. Herein it differs from the electric lighting of private premises, and it is necessary to note the difference. Electric lighting is the cheapest as well as the best light for streets and public places. For private premises, on the contrary, electric light is not a cheap light under usual conditions. It is not now and it is not likely to become an illuminant of universal use to the exclusion of gas and oil. Why this is necessarily so is well known to the members of the association. To the general public it is a statement better proven by a couple of good examples than by a long statement of causes. In the city of Detroit there were, in 1897, according to the annual report of the Water Board, 52,219 supply connections to the city water mains and the "families" in the city were 54,945. Each "family" was certainly a user of artificial light of some kind. Illuminating gas of 18 candle power quality is sold in the city of Detroit at $1 per thousand cubic feet. The maximum price charged by electric-lighting companies for incandescent lighting is 14.4 cents per kilowatt-hour, including renewals of incandescent lamps; the minimum is four cents, and the system of charging makes the average price 10.8 cents per kilowatt-hour, which, allowing for difference in candle power, is equivalent to gas at $1.21½ per thousand cubic feet on the average, or to gas at $1.62 to the customer whose individual load factor obliges him to pay the maximum price. These are comparatively low prices, both for gas and electricity. Under these circumstances there are in the city of Detroit approximately 18,000 (?) customers for illuminating gas, and 4,000 customers for incandescent-electric light. What light do the remaining three-fifths of the possible customers use? It is safe to say that they use kerosene oil. It is also safe to say that there are very few cases where oil is used merely because gas or electricity is not available. The main cause of the use of oil is its lower cost. I need not say to this audience, although I have found it necessary to make the statement to other audiences which were entitled to be considered intelligent, that there is not the least likelihood of the production costs of kerosene oil, of gas and of electric light materially changing their ratios to one another. As to their selling prices, I think that the Standard Oil company is better satisfied with the profit which it makes on the sale of kerosene in Detroit, than is either the Detroit Gas company or the electric-light company in that city with its profits.

I submit, however a second example of the relative cheapness of gas and electricity, from which example the question of profit is eliminated. The city of Glasgow, Scotland, owns and operates its gas works and owns and operates its electric-lighting plant. Neither of them is intended to make a profit. I have in my possession signed communications from the managers of each department in which it is written that the price of gas is two shillings and two pence per thousand cubic feet, and that the price of electricity for incandescent lighting (not including renewals of incandescent lamps) is six pence per kilowatt-hour for the first hour's use of the demand, according to a Wright meter, and 2½ pence per kilowatt-hour thereafter. Making the same corrections as in the Detroit calculation and assuming that the incandescent lamps paid for as "extras" in Glasgow are as efficient as those furnished free by the Edison Illuminating company of Detroit, the Glasgow price for gas is 52 cents per thousand, and the Glasgow price for incandescent lighting is equivalent to gas at $1.35 at the maximum rate, and 56¼ cents at the minimum rate. The average is about the same as the Detroit average. I think this example from a city where municipal ownership has been most thoroughly exploited, and where the municipal management is above suspicion of inefficiency or corruption, proves beyond question that electric lighting for private use is a luxury, and as such must continue to be used only by those who can afford luxuries; that is to say, by a minority of the citizens of any municipality; not by a majority, much less by every citizen.

Therefore, while it is admitted that the lighting of the streets is truly a public service, which may be performed by the municipality for and on behalf of every citizen, the furnishing of electric light to private consumers is not a public service, but is essentially a service to a few individuals, and as such should not be undertaken by a municipality whose object is to perform only those duties which municipal society as a whole owes to itself as a whole. This principle should be clearly understood, and should be boldly maintained. It is necessary that a municipality shall undertake certain services, and it is possible that it may undertake others, but the propriety of its undertaking any service depends on whether that service is to the public or to individuals; to the many or only to the favored few.

Possibility of Low Contract Prices.

This leaves to private enterprise the supply of electric light to private consumers. In performing this service there will be built and equipped a power house; there will be organized an operating and a managing force; there will be constructed lines of distribution. All of these may be, and part of them certainly will be, adapted to the performance of public lighting, in addition to the service of private consumers. To whatever extent this double adaptability exists in the private plant, there will be duplication of equipment in any other plant separately established for performance of the public work. Moreover, it is peculiarly characteristic of public lighting operated all night that its addition to the ordinary work of a private lighting plant tends to reduce the average cost of the combined output. In these considerations rests the possibility of a contractor profitably performing public lighting for a city at or below the price at which the city can itself do the work, and yet it being to the interest of the contractor to undertake the business.

Let us for a minute assume that municipal engineering and management and municipal financing can be just as good as private engineering and private financiering. If they are not so, it is the fault of the municipality, because technical and financial skill and executive ability are for sale in the labor market and are purchasable by a municipality, even as they are by private employers. There remains only one evident cause which should tend to make the costs of a municipal plant differ from that owned by an individual or a company. That difference is that the individual proposes to make a profit and the municipality does not. Looking closer at the facts we find that the municipality must in most cases allow the equivalent to a profit, because a municipal plant is built by money borrowed at interest. In the case where the money is not borrowed, but raised by direct assessment, the municipality has prevented some of its citizens from profitably using the money taken from them by taxation to be invested in the lighting plant, so that even in the exceptional case the possible profit to the taxpayer on the money withdrawn from his business has to be considered. But the rate of interest on municipal bonds is usually less than the rate of profit which a private owner is willing to accept on money invested in the electric-lighting business. It is four per cent. as against six or seven or eight per cent. In the final analysis the difference between the cost of lighting by contract and that of lighting at cost by a municipally owned plant should not exceed four per cent. on the capital invested in the plant. I assume in making this statement that the rate of interest on city bonds is a fair measure of the profit that investors expect on a secure investment. If the investment in an electric-lighting plant were equally secure, the rate of interest necessary would be no greater. The security depends so largely on the policy of the municipal authorities that it may approximate to that of municipal bonds on the one hand; or, on the other, it may be of the same order as the stock of a speculative gold mine or a Klondike expedition. In saying that the difference should not exceed four per cent., I am to be understood as implying such conditions as take the investment out of the speculative class. I am also to be understood as implying that proper salaries for management have already been paid out of earnings, and that the profit mentioned is that payable to capital alone; in other words, an exact parallel to the payment of interest on a municipal bond.

Advantage of the Contractor.

It follows that if the organization and equipment of an existing plant engaged in the supply of electric light to private consumers is available for the purpose of performing public lighting, this maximum difference of four per cent. can be thereby reduced or even reversed. In every case the difference should be reversible. There are causes to be considered later which tend to the contrary, but the fact remains that there is no irremovable cause why an existing electric-lighting plant should not be able to perform public lighting at a less price than the municipality can do the work itself.

Disadvantage of the Contractor.

Of the causes which tend to the contrary, one is that the plant which has a contract for public lighting may have very little private service, or none at all. Some other plant in the same city may do all or most of the private business. This condition of affairs can be only temporary. The consolidation of the two plants is an economic necessity, certain to arrive in time. The only condition justifying the existence of two plants in the same city is that the city is so large as to make a division of territory desirable; and even in that case an operating agreement is to be preferred to complete independence.

The public has been told that consolidation of plants is not to the public interest. This is an error, and the way to prove it such is to give to the public the surplus profits of consolidation in the shape of lower rates and better service—either or both.

Another cause tending to handicap the contractor is that few municipalities will make contract for a long term of service. Even the advocates of municipal ownership who are willing to issue 20 or 30-year electric light bonds, and who will not write off more than three or four per cent. for depreciation of plant in making their estimates of city operation, will protest against a contract running more than a year or two. They claim for the municipal plant all the advantage of a secure investment, and simultaneously deny these advantages to the contractor. We know that the securing of a long-term contract permits the installation of the most economically operated machinery, and reduces the percentage of profit, which must be earned annually. The objection to the long contract, that it denies to the city any share in the profits of possible improvements effected during the term of the contract, can be met by so drawing the contract that the margin of profit shall plainly be reasonable to begin with, and that the city may share in the results of improvements in consideration of guaranteeing a similar reasonable profit on the investment to be made in such improvements. A 10 or 20 year contract with such a clause could be safely taken at a very low price.

A possible solution of this problem is city ownership of the plant, combined with operation by a contractor. I think that this plan may by and by become common. It involves too many details to permit of my discussing it at present.

The very worst handicap that a contractor may have to carry is excessive capitalization. Here it must be noted that many municipally owned lighting plants do not report all their capital expenditure, so that in carelessly made comparisons of fixed charges the contractor appears to have overstated his investment in order to increase the apparent cost of operation. Any comparison must be on an identical basis for capital as well as for operating charges. And for the purpose of adjusting

prices between municipality and contractor, only one basis for capital charge is acceptable; namely, the present value of the plant—in brief, a properly made inventory. This proposition is so radical that I state the reasons for it.

Capital Account.

The possible bases for a capital charge are as follows: First—The face value of the securities issued by the plant. That this is an impossible base of adjustment is too well known to all electric-light men. Second—The current market value of these securities. This is impracticable, because many securities are not on the market, and because the immediate earning capacity of a plant affects the price of its securities, and because—last, but not least—some securities are speculative rather than industrial. Third—The actual cost of the plant. This would be proper if all plants had been built at the same time and if no plant had been obliged to be rebuilt. As it is, the construction cost of two plants built, the one in 1888 and the other in 1898, the two of identical capacity and of similar type, may be to one another as two to one; the earlier plant may have cost twice what was paid for the later, solely because the reductions in the prices of machinery and material of construction in the last 10 years.

The only remaining possible base for a capital charge is the present value of the plant; and I do not think that any other can be made acceptable for the specific purpose of adjusting a price for public lighting. It does not follow that the capital account is to be readjusted to a corresponding figure. It is only requisite that the company accept as a proper profit on public-lighting business an allowance based on inventory value of the investment. It would be well for the industry, however, if all our capitalizations were brought near to present values. And one good result of revaluation would be a logical sequence; the depreciation of the investment from year to year would necessarily be admitted as a proper charge against revenue. If a profit is only to be allowed on capital sufficient to construct a plant at the comparatively low construction prices now ruling, any further decline in cost of construction must be considered an impairment of capital, to be made good before any profit can be paid. It is not to be understood that I expect an electric-lighting company to stop dividends or to reduce capital stock in order to make good in any one year an extraordinary depreciation charge, due, for instance, to the replacement in the year of old-type machinery with new, in order to meet a public demand for a higher grade of service. Such extraordinary charges must be financed according to well understood rules. The loss of value of the old machinery does not occur in an instant, but is a process continuing through several years. So far as is possible, this loss of value should be anticipated by charges made in advance, in other words, by the accumulation of a renewal fund. But where this has not been done, the charges should be distributed over a proper period with due regard to all interests involved, in other words, so as to secure the greatest good for the greatest number. The principle is all important. The detail as to how a proper depreciation charge shall be put on the books is a matter to be disposed of in the most convenient manner.

Conclusion.

Having recited my premises, I now state my proposed policy as a recommendation, as follows:

I recommend that the association declare by resolution:

1. That a municipality may properly provide for public lighting either by the ownership and operation of an electric-lighting plant, by the operation of a contractor under lease of a municipally owned plant or by contract with the owner of a private plant.

2. That the supply of electric light to private users is not properly a municipal function.

3. That the performance of public lighting under contract by a private plant in connection with the supply of electric light to private users is essentially the method of least expense.

4. That the existence of two electric-lighting plants in the same territory is an economic error tending to increase the cost of production, and thereby the selling price; and that the maintenance of competition is to the detriment of the public.

5. That public lighting by contract should be performed at the lowest price consistent with a reasonable profit on the value of the investment; that no electric lighting contractor should demand more than such a profit, and that each municipality should protect the contractor in the enjoyment of his profit and against impairment of his investment, in order that a minimum profit may become reasonable.

6. That in order to adjust prices in the absence of competition it is necessary that costs be ascertained and prices approved by a competent authority, acceptable to the public as well as to the contractor.

7. That in the absence of a constituted authority competent to ascertain costs and prescribe prices, members having public lighting contracts under consideration should endeavor to have the adjustment of the contract price undertaken by a temporary commission or arbitration committee, who will adopt as the basis of adjustment the principles set forth in these resolutions, particularly in resolution number 5.

8. That there is no essential difference in the organization of municipally owned plants requiring a different analysis of costs from that which is proper for private enterprises, and that the publication of the costs of municipal lighting plants, properly analyzed, is beneficial to the electric-lighting industry. Further, that the similar publication of the costs of private plants is desirable, but is at present impossible because of its advantages to actual or possible competitors.

In conclusion, I desire to say that the tendency of public opinion appears to be toward some interference by and on behalf of the public with corporations performing so-called public services. Such a tendency is a concomitant of our social progress. It is not merely a temporary surge, but is a part of a general movement. It cannot be withstood, but may be guided into proper channels. The general result of any such movement is for good, the damage which is done to individual rights is incidental, and is more often the result of needless opposition by the individual. In this matter of public lighting the right of the community to interfere is so evident that it has been one of the first subjects considered, and will be one of the first disposed of; and its priority in time will establish its disposition as a precedent for the future disposition of similar questions. There is immediate need for clear thinking and for well-considered speech and action—for speech telling the public that electric-lighting companies desire to do business according to the golden rule, and for action plainly in conformity with the speech. I believe that this association can appropriately speak for its membership, and that its members are willing to live up to the principles which the association may enunciate.

Discussion.

H. M. Atkinson, Atlanta, Ga.: I take it that it is not the purpose here to discuss specific cases or grievances. Such an association as this should adopt a platform enunciating its principles on this question, which by its conservatism, temperate tone, fairness and broadness will appeal to the taxpayer and intelligent voter. This platform should be carefully prepared, should avoid anything aggressive in its tone or calculated to excite the opposition of advocates of the policy. We should state that we are opposed to municipal ownership on principle, not alone as owners of electric-lighting companies, but as taxpayers ourselves. We should state the we are not engaged in a partisan fight, and not that whenever one of our members is attacked, he is of necessity right and must be protected, but that circumstances will solely govern the position we take in each case. We should state that after long experience and earnest study, we, as honest business men, believe that private corporate service under proper legislative control is far better than municipal ownership. We must distinctly state that we will not uphold our members unless they are honestly endeavoring to give the best service at the very lowest living prices, taking into consideration local conditions. We must show that private ownership under proper control means all the advantages of public ownership without any of the risks. We should emphasize the conditions of legislative protection as it exists in France and this country in Massachusetts. We should dwell on the depreciation and losses to which we have been subjected during the past 10 years and still are. We should counteract the prevailing idea of great profit in the business. We should condemn at the start high prices and the policy of those who exact them, putting ourselves on record that as street-lighting contracts cover long hours and much consumption that they should be treated accordingly.

We should adopt a standard system of accounts for ourselves, and advocate the adoption of such a system by every municipality—one that will appeal to all business men, interested or not. We should endeavor to show that cities adopting this policy are providing the soil upon which rings and corruption exist, and without which they cannot. We should counsel fair and accurate expressions of facts and figures on both sides, emphasizing the injustice done by careless, inaccurate, unstudied statements. We should urge more complete and adequate methods of bookkeeping in all municipalities. We should drive home in the minds of the people that a city's only source of income is through taxation or bond issues, which mean taxation perpetuated; that every dollar raised by the former method is costing them interest as much as the latter. We must urge that cities count cost as fully as private persons. Our fight, in short, is the fight for good and honest government. We must stand fairly on the platform that we, as taxpayers, as well as owners of electric-light works, are opposed to the policy of municipal ownership and operation, as our experience has shown us what it is. We must show how legislative control, requirements and penalties create a degree of responsibility which never exists as regards a municipal corporation; how elimination of the factor of self-interest is an effective barrier to economy in production or operation on the part of a municipal corporation, and always will be; that private enterprise will always outstrip municipal ownership in filling the gap between supply and demand; that under contract cost is limited to the price, and under municipal control cost is not limited. We should point out the difficulty of ever getting true statements of cost if this policy is inaugurated, as advocates of it will not willingly issue statements condemnatory of themselves, and politicians will not take action that will decrease their patronage. It should be pointed out to taxpayers and voters that municipal ownership of electric-light plants will only be a stepping-stone to ownership of numerous other industries, for if ownership of one is advisable, why not all?

We should educate public opinion to the unfairness of municipal competition with capital invited and encouraged to occupy the field when an industry is an experiment, as long as such capital furnishes good service at a fair price, and that such competition is equivalent to condemnation and confiscation of property without compensation.

Samuel Scovil, Cleveland: Each of us, I think, will agree with the statement that Mr. Dow makes in closing his able paper, that there is immediate need for clear thinking and for well-considered speech and action in reference to the attitude being assumed by the public toward those corporations performing so-called public services.

Most of will agree that in some measure the hostility in the public mind toward these corporations is the logical outcome of the methods which some of the companies have pursued, which in themselves are most reprehensible, whether they were adopted voluntarily or involuntarily. Nothing is to be gained by denying that this has been an important factor in bringing about the conditions with which we now have to deal. While willing to admit the truth of this statement, I hold, however, that the hostility alluded to is in quite as great a degree attributable to the teachings, misrepresentations and accusations of a certain school of theorists and dreamers whose one universal remedy for every political ill, real or imaginary, is to increase the functions of government.

Certainly this association can do its members no greater service, and incidentally the other corporations performing quasi-public services, than by adopting some plan of action looking toward an improvement in the relations of those companies which it directly represents with the communities which they serve. How best to accomplish this most desirable result is a problem not easy to solve.

In regard to public lighting only, Mr. Dow advocates a declaration of principles by the association and a recommendation by it to its members of a policy based on those principles. If his suggestion be acted upon, the association must be careful that the principles which it enunciates and the recommendations accompanying them shall be such that wherever they may be fully accepted and adopted they will result in reasonable prices being offered to the municipality and a fair return to the company upon its invested capital.

I use the words "invested capital" advisedly, for I take decided exception to the principle laid down by Mr. Dow, that the present value only of a lighting plant is the proper basis upon which to adjust a price for public lighting. The growth of the electric-lighting industry has been almost unexampled in rapidity, and as a natural sequence much of the apparatus originally installed in the average lighting plant has been replaced not once, but several times, because it had been obsolete. This was no ordinary depreciation such as might properly have been anticipated. It was extraordinary in its character and in a degree. For reasons well understood by you, it was impossible for the managers of these plants to secure a price for the service rendered by them which would allow them to cover this depreciation, even could they have anticipated it. As a case in point, I will state that I am informed that there is not in use to-day in the lighting plants owned by the city of Chicago one single piece of the electrical apparatus placed in service when the original plant commenced operation. It was the necessity of buying new equipment and charging its cost to operating expenses that made the cost of operating street arc lamps by the municipal plant of Chicago for labor and material only $96.40 per lamp per year. You will find these figures given as the cost on page 35 of the mayor's message for 1896.

Aside from this fact, the original investors in electric-lighting apparatus had to pay for patent rights, and these constituted no inconsiderable part of the aggregate amount of capital which they had to put into the business. In an article by the president of this association on the "Development of the Central Station," he says that in the early days of the business it was necessary to do the cheapest possible engineering and construction in order to meet the necessities of the slim exchequers of those who were bold enough to embark their capital in this business. There was no clamor then for the municipality to municipalize the industry.

Let us assume that a municipality had 10 to 15 years ago built a plant for itself. The municipality, if it kept its service up to date, would necessarily have had the same experience as did the private owner in reference to replacements. How would the cost of its plant compare with the cost of its replacement to-day? It could probably be duplicated for less than half its cost.

Now, if an expert were sent to that town to ascertain what it was costing it to do its public lighting, would he be justified in ignoring the total capital expenditures made on its plant and take only one-half of such expenditure, because the plant could be replaced to-day for that amount? To put the case another way. Suppose the municipality had issued bonds for the total expenditure on its plant, and these bonds, as would probably be the case, were now outstanding, no one would deny that the interest on such bonds would necessarily be a part of the cost of its public-lighting service.

This is in a measure the position which many of the private-lighting plants are in to day. Moreover,

it is a fact that it has been the very readiness of the private-lighting companies to replace and enlarge their original installations, and of the street-car companies to do likewise, that has made possible the great development both as to efficiency and cost of the electrical appliance of to-day. If the municipalities had undertaken the business entirely at the outset, it is not at all unlikely that the development and consequent extraordinary depreciation would not have been anything like as rapid.

As bearing upon this point, let me call your attention to some figures in an article in the March issue of Lighting, an English paper. The writer says that the extent to which street arc lighting has been taken up in England bears no reasonable proportion to the state of things which should really exist, and which does exist, in America, and then give tables showing that in the American towns in 45 states, having a gross population of 14,384,000, there were 60,397 arc lamps, whereas, in 31 English towns, with a population of 7,497,079, there were 3,864 arcs, or in America one lamp to every 250 people, as against one lamp to every 1,940 people in England.

As I understand it, the proposition made by Mr. Dow, if accepted by this association, might well be stated in a resolution, as follows:

"Resolved, That we, the managers of private-lighting companies, in convention assembled, deliberately declare that it is perfectly equitable that part of the capital which we have invested in good faith and with commendable enterprise be now confiscated by the municipality which we have been serving."

In this connection let me call your attention to the position taken by Professor Ely of the University of Wisconsin, one of the foremost and ablest of the advocates of municipal ownership. He says: "The mode of accomplishment (in changing from private to municipal ownership) of course requires careful consideration, but only a few suggestions can be thrown out at present. One of the most important is that a fair, but never excessive, value should be paid for the property acquired, and a fair value does not mean simply the cost of duplication of a plant."

The professor's position is simple justice. He recognizes the right of private owners to their investments.

Do not misunderstand me, gentlemen. I do not claim that a municipality should pay more for its public lighting than it could do the work for itself. What I do claim is that there is nothing in the history of municipally conducted industries, either at home or abroad, which would indicate that they can approach the privately conducted enterprises in economy of operation, if the municipality will grant and secure to the private company the same privileges and security that it assumes for itself.

As a well-known writer states it: "There is an economic advantage inherent in private ownership that cannot be acquired by a municipality. The operation of this advantage creates the profit for which the private company works, and which, when created, belongs to those creating it as justly as the pay for a day's work belongs to the honest workman. This economic advantage ceases to exist when an industry passes from private to municipal ownership. This advantage stimulates enterprise, induces thoughtful care and inspires energy."

The margin of difference between the two systems will, in my judgment, allow the private companies a reasonable return on the capital they have invested in their plants. To take the present value of these plants and oblige the private companies to furnish services on such a cost, is to assume that the municipality has a right to wipe out capital which it invited into its service, and then to take unto itself in addition all the economies that result from an intelligent self-interest.

There is one other principle which Mr. Dow asks us to accept, to which I think exception should also be taken. He says: "The only sufficient reason why a municipality should contract with a private company for public lighting is that the private company can do the work, and is willing to do it, cheaper than the municipality can itself do it by direct operation of a public-lighting plant."

In my opinion preference should in every case be given to the private company at the same cost. A contract made with a private company is a known expense. Municipal ownership and operation is an unknown expense. Aside from this fact, however, there is a larger and an all-sufficient reason why private enterprise should be given the preference, and individual effort be thereby stimulated.

The question as to whether the municipalities of this country shall own and operate their own lighting plants may seem to be a small matter, except to those whose money is invested in such plants. The axiom that it is the first steps which count is as true of a community as it is of an individual. Once fairly started upon the policy of the municipalization of all public utilities, and who can tell where governmental interference with individual effort will stop. Will it stop with the municipalities? No! Led by the theorists, dreamers and politicians, the unthinking masses will cry more, more, and the inevitable result will be the institution finally in our civic, state and national governments of a crushing bureaucratic system that will seek to regulate almost every activity of the individual from the cradle to the grave the substitution of the paternalism of a despot for the free government of a democracy. All history and experience show that wherever a people have intrusted their liberties to their representatives, to be exercised through a centralized power, these liberties have been lost to them. Instead, therefore, of taking any steps in the direction of the restraint of individual effort and private initiative, let us hold fast to the fundamental principle enunciated by the fathers of this republic, that the only government of a free democracy is limited to the preservation of order and the enforcement of justice.

The following would seem to be much more acceptable than Mr. Dow's proposition, and be more in accord with American institutions, which is to interfere as little as possible with the individual activities of the citizen.

"The best interests of the public welfare require that a municipality should contract with a private company for its public lighting, if the private company can do the work, and is willing to do it at a cost not greater than if supplied by a plant owned and operated by the municipality itself."

Northwestern Electrical Association.

[*Continued from page 359*]

the Calumet and Hecla Mining company has been sunk to the immense vertical depth of nearly a mile. Included in this vast mining property are engines of over 6,000 horse power, combined in one house.

After the inspection of the first installation, it being then afternoon, the party was driven to the Calumet armory, where lunch had been prepared by the Calumet and Hecla company. The delegates greatly appreciated the courtesies shown them by this company and were especially pleased with the kind hospitality of Captain Duncan and Electrical Engineer F. N. Bosson. Mr. Bosson will be remembered as one of the railway engineers of the Thomson-Houston company, who for several years was connected with the western railway department of the Thomson-Houston company, with headquarters in Chicago.

About 4:30 the Northwest was cast loose and started for Duluth, through the Portage Canal. This ride through the canal proved to be one of the most picturesque of the entire trip. Words cannot describe the natural forest beauties as seen from the deck of the steamer, as she slowly pushed on through this narrow waterway, with the green foliage on both sides almost within reach.

To say that the party was entertained at Duluth would convey but a poor idea of the hospitality extended. The mayors of Duluth and West Superior, together with their committees, literally gave the freedom of the town to the convention, and if kindness could kill, there would now be a number of deceased delegates. After the last regular convention meeting in the Duluth City Hall the members were taken on a most enjoyable coaching party over the hill boulevard, overlooking Duluth. Views of the town and harbor, as seen from the steamer, and also a picture of the coaching party on the boulevard, are presented in this issue. This delightful drive was finished about five o'clock, and the whole party was then landed at the docks, where a large boat in the tow of a tug conveyed the delegates about the harbor. About seven o'clock the party was landed at West Superior, and in charge of Mayor Dietrich, repaired to the hotel to prepare for the evening's entertainment. The banquet was a pleasant affair, and was attend by about 125 persons. Mayor Dietrich extended to the members of the association and other distinguished guests a hearty welcome and the freedom of the two cities. Mayor Deitrich then introduced Mr. Wilson G. Crosby, the toastmaster of the evening. Mr. Crosby responded in a happy speech. President Copeland was the first speaker. He was followed by Mayor Truelson, ex-Governor William R. Merriam, Professor Elisha Gray, F. B. Clark, Professor Fujioka and Thomas R. Mercein.

At noon Wednesday the party took the train for Minneapolis and arrived in time to partake of a dinner that had been prepared at the Minneapolis Mercantile club, through the courtesy of President Morgan Brooks of the Electrical Engineering company of Minneapolis. It was almost dark when the party took the coaches that had been provided by Mr. Brooks and was driven to the lakes through the parks of Minneapolis. At about nine o'clock the coaches landed at the train and the journey was concluded by the arrival in Chicago Thursday morning at 9:30.

Presentation to J. M. Hill.

One of the most interesting and pleasing features of the entire trip was that through which Master of Transportation Joseph M. Hill was presented with a token of the high appreciation felt by the members of the party for his efforts in bringing the trip to a successful conclusion. The members of the party were so much impressed with the care and thoughtfulness exhibited by Mr. Hill in planning the trip and carrying it out successfully in every detail, that while on the Northwest all hands contributed for some token of appreciation, and President Copeland and Secretary Mercein were appointed to elect something appropriate as a gift for Mr. Hill. In Duluth a scarf pin was purchased and held in reserve for presentation when a suitable opportunity was found. In Minneapolis, after the dinner at the Mercantile club, Secretary Mercein arose, and, in a few highly complimentary and well deserved remarks, told Mr. Hill how much credit was due him, and how highly all on board the Northwest had appreciated his work. The diamond scarf-pin was then presented to Mr. Hill, who responded in a few well-chosen words, saying that he really felt that the credit should not be given to him, but to all hands on board, for having united in making the undertaking successful.

Members and Guests.

Following is a list of the members of the association and their guests who left Chicago on the steamer Northwest:

Abadie, E. H.	St. Louis.
Adams, R. N.	Sault Ste. Marie, Mich.
Anderson, H. S.	Springfield
Arnold, B. J., and wife	Chicago.
Atkinson, H. M.	Atlanta.
Baker, John S.	Evansville, Wis.
Banks, W. B.	Superior, Wis.
Boyer, F. N.	Chicago.
Brooks, Frederick	Boston.
Brooks, Morgan	Minneapolis.
Brooks, H. H.	Boston.
Candee, W. L.	New York.
Carr, Robert F.	Chicago.
Caverly, Will	
Chandler, William	Sault Ste. Marie.
Church, J. V. S.	Chicago.
Cleland, Miss Eliza	Evansville, Wis.
Comstock, L. K.	Chicago.
Copeland, F. A.	La Crosse, Wis.
Cross, A. A.	West Superior.
Dailey, W. W.	Chicago.
Daniels, A. L.	Aultman, O
Darley, W. W.	Chicago.
Darling, Dr.	Sault Ste. Marie, Mich.
Dee, James R.	Houghton, Mich.
Desenberg, L. J.	Sault Ste. Marie.
Dietrich, Mayor	West Superior.
Doane, S. E.	Marlborough, Mass.
Doherty, Henry L.	Madison, Wis.
Donohoe, F. E.	Chicago.
Dow, Herbert H.	Midland, Mich.
Downs, B. B.	Minneapolis.
Dysterud, E.	Monterey, Mex.
Easterday, Rev. G. R.	Sault Ste. Marie, Mich.
Edgar, H. T.	Boston.
Ely, J. N.	Atlanta, Ga.
Ferguson, Mr.	Sault Ste. Marie, Mich.
Ferris, Thomas	Milwaukee.
Fitzgerald, Mr., and wife	Duluth.
Frego, Charles H.	Hoopeston, Ill.
Friend, W. H., and wife	Vincennes.
Fujioka, Ichisuke	Tokyo, Japan.
Goodwin, H. D., and wife	Milwaukee.
Goodwin, Hugo P.	Milwaukee.
Gray, Elisha, and wife	Highland Park, Ill.
Hapeman, Douglas	Ottawa, Ill.
Harding, J. H.	Laporte, Ind.
Hartman, O. C.	Duluth.
Hergett, H., and wife	Pekin, Ill.
Heskett, R. M.	Green Bay, Wis.
Hill, J. M., and wife	Chicago.
Howell, Willson	Harrison, N. J.
Hull, J. W.	Steubenville, O.
Jennings, J. J.	Wilkinsburg, Pa.
Johns, S. C. D., and wife	Cleveland, O.
Kehler, C. S.	Chicago.
Kelliher, P. C.	Sault Ste. Marie, Mich.
Kimball, F. M.	Boston.
Kingman, W. F.	Sault Ste. Marie.
Kittle, E. B.	Chicago.
Knight, W. C.	Fort Wayne.
Knutson, J. B.	La Crosse.
Korst, P. H.	Racine, Wis.
Land, Edna	
Lang, A. E., and wife	Toledo, O.
Leland, C. F.	Duluth.
Loomis, J.	Cheboygan, Mich
Lowerie, W. M.	Chicago.
Mabbs, J. W.	Chicago.
Maloney, H. C.	Chicago.
Manson, G. T.	New York.
Marsh, Converse D.	New York.
McDonald, Mrs. S. D.	Chicago.
McDonald, J. J.	Chicago.
McGraw, James H.	New York.
McKinlock, George A.	Chicago.
Mercein, Thomas R.	Milwaukee.
O'Connor, Wallace	Chicago.
Osborne, Chase S.	Sault Ste. Marie, Mich.
Packard, W. D.	Warren, O.
Page, A. D.	Harrison, N. J.
Barker, W. F.	Boston, Mass.
Parker, Miss	Evanston.
Paul, A. G., and wife	Chicago.
Perrin, Mr.	West Superior
Perry, F. L.	Chicago.
Phillips, F. N.	Providence.
Pierce, Mr.	Negaunee
Price, C. W.	New York.
Randolph, L. S.	Blacksburg, Va.
Rex, George	St. Louis.
Ripley, Joseph	Sault Ste. Marie, Mich.
Ross, C. A.	Chicago
Ross, Max	Chicago.
Rugg, W. S.	Chicago.
Scanlan, P. H., and wife	St. Paul, Minn.
Schayer, J. J.	Chicago.
Scovill, S., and wife	Cleveland, O.
Simons, O. H.	Duluth.
Slate, H. C.	Milwaukee, Wis
Smith, H. E.	Duluth.
Smith, W. S.	Toledo.
Stacey, Thomas I., and wife	Chicago.
Stern, M. L.	Denver, Colo.
Taylor, F. L.	Duluth.
Truelson, Henry	Duluth, Minn.
Underwood, H. G., and wife	Milwaukee.
Upham, W. P.	Chicago.
Wagner, H. A.	St. Louis.
Warren, Arthur	Pittsburg.
Wetzler, Joseph, and wife	New York.
Wigh, Edith	Hancock.
Wigh, Charles	Hancock.
Wilkinson, C. D.	Chicago
Wilkinson, Samuel	Northville, Mich
Williams, Charles P.	La Crosse.
Williams, George V.	Chicago
Willson, R. A.	Marquette
Woodbridge, J. E.	New York
Wurts, A. J., and wife	Pittsburg

Convention Notes.

H. L. Doherty of Madison was there in good voice and fine feather.

The Columbia Lamp company of St. Louis was represented by Guy. F. Williams, who is traveling

in Minnesota, Iowa, Wisconsin, Nebraska, Missouri and Illinois.

Warren, O., was represented by W. D. Packard, of Packard lamp fame.

A. J. Wurts, of lightning arrester fame, was accompanied by Mrs. Wurts.

Prof. Elisha Gray and wife of Highland Park, Ill., were among the distinguished visitors.

Sault Ste. Marie was well represented in the persons of L. J. Desenberg and W. F. Kingman.

James R. Dee of Houghton, Mich., the man that knows all about copper, did the honors for his city.

Converse D. Marsh illuminated the whole ship. Of course the Bryan-Marsh lamp had nothing to do with this.

H. F. Edgar came clear from Boston, and H. M. Atkinson thought enough of the convention to run up from Atlanta, Ga.

Mrs. Joseph Wetzler accompanied her husband on the Northwestern trip. Mrs. Wetzler is an accomplished musician.

Capt. Willard L. Candee, George T. Manson. George A. McKinlock and Charles W. Price promenaded the deck together.

"Tom Ferris," the General Electric representative, carried the company's banner through the wild Northwestern territory.

H. G. Underwood, the well-known patent attorney, was one of the Milwaukee contingent. He was accompanied by Mrs. Underwood.

That popular "G. E." man, F. N. Boyer, did the honors, and did them well, for Western Manager B. E. Sunny of the General Electric company.

Col. Copeland, president of the Northwestern association, will be remembered as having headed the most unique convention that ever "went on the road."

E. B. Kittle, now representing the Sprague Electric company as western manager, with headquarters in Chicago, made his first Northwestern convention trip.

E. Dysterud of Monterey, Mexico, proved a typical man from Mexico. Mr. Dysterud came all the way from Monterey, and nobly did he do the honors for his country.

George Rex, the popular representative of the Columbia Lamp company, took the place of Secretary A. C. Garrison, who was compelled to return after the national convention.

A number of ladies went as far as Milwaukee. Among these might be mentioned the Misses Parker, who were the guests of Mrs. Stacey; Mrs. Scovil of Cleveland and Mrs. Frank L. Perry of Chicago.

Frank L. Taylor, proprietor of the Spalding of Duluth, joined the party at Chicago, and accompanied the visitors to Duluth. Mr. Taylor won much applause by his most skillful sleight-of-hand entertainments.

Prof. Ichisuke Fujioka of Tokyo, Japan, was voted not only a man of rare scientific attainments and great sociability, but a "good fellow" as well. The professor made the hit of the evening among the speeches at the Soo.

The Central Electric company's Northwestern representative, W. P. Upham, was on board. Mr. Upham added a great deal to the pleasure of the ladies, assisting in the games and proving himself generally a good fellow.

A. L. Daniels of the H. B. Camp company of Aultman, O., who had been in attendance at the National convention in Chicago, went on to Duluth with the steamboat party. Mr. Daniels added to his already large number of friends.

Mrs. W. H. Friend of Vincennes won the second shuffleboard prize on Monday afternoon; it was an electric curling iron of unique pattern that had been presented through the courtesy of the Electric Appliance company of Chicago.

H. T. Edgar of the Jandus and Buckeye interests in Boston left his partner, Cooke, behind, and did the convention alone. Mr. Edgar is a Bostonian with a keen eye to business. He was warmly welcomed by his "Indian" friends.

Supt. S. E. Doane of the Bryan-Marsh lamp factory accompanied President Marsh. Mr. Doane's paper was most interesting and was greatly appreciated by all those interested in the minutiae of the science of incandescent lamp manufacture.

R. B. Snyder of the Superior Leader and Representative Miller of the Duluth Herald gave most excellent and correct reports of the proceedings, and did all in their p[illegible] pleasant the stay of the delegates in their respective cities.

Manager Arthur Warren of the advertising department of the Westinghouse company seized the opportunity of making himself acquainted with the Northwestern contingent. Mr. Warren recently took charge of the advertising department of the Westinghouse company. It is to be hoped that Mr. Warren will not let this be his last Northwestern convention.

W. W. Darley, representing Manoz & Darley, the Rookery, Chicago, reminded all that the Cahall water-tube boilers, manufactured by the Aultman & Taylor Machinery company, Mansfield, Ohio, were just the thing for electric-lighting service.

C. D. Wilkinson of Chicago, better known as "Western Electric Wilkinson," in company with L. K. Comstock, were made welcome. Messrs. Wilkinson and Comstock had a hard time to escape from their friends, especially at the Soo.

Abadie of St. Louis was everywhere, and with a smiling countenance, always full of life and geniality, he never lost an opportunity to keep the Wagner specialties to the front. Herbert A. Wagner accompanied the steamboat party as far as Milwaukee.

Henry D. Goodwin and Mrs. Goodwin, together with their son, Hugo P. Goodwin, were among the passengers. Mr. Henry D. Goodwin is the stenographer of the association. Mr. Hugo P. Goodwin won much praise for his skillful work on the piano.

President Morgan Brooks of the Electrical Engineering company of Minneapolis, in company with L. S. Randolph of Blacksburg, Va., and his brother, Frederick Brooks of Boston, Mass., represented the greatest city in the Northwest, to say nothing of "the greatest supply house" of the Northwest.

Secretary Thomas I. Stacey of the Electrical Appliance company enjoyed the trip hugely. Mr. Stacey was accompanied by Mrs. Stacey and the Misses Parker, one of Evanston and one of Iowa. The Electrical Appliance party also included the company's Minneapolis representative, B. B. Downs.

J. W. Hull, formerly of Steubenville, O., and more recently of New York and Chicago, attended, and was a universal favorite with the ladies on board the Northwest. Mr. Hull is the representative of the Cabinet Manufacturing company of Steubenville, O., that is now making a specialty of telephone woodwork.

P. H. Scanlan, the courteous and energetic traveling passenger agent of the Chicago, Milwaukee and St. Paul Railway company, was one of the most welcome guests on the Northwest. Mr. Scanlan had been delegated by his company to look after the return trip of the delegates from Duluth to Chicago.

The newspaper men on board were Charles W. Price of the Electrical Review, James H. McGraw of the American Electrician, J. V. S. Church and J. Edwards Woodbridge of the Electrical World, Joseph Wetzler of the Electrical Engineer, Frank L. Perry of the Western Electrician and H. M. Swetland of Power.

One of the men warmly welcomed was H. H. Brooks of the Circular Loom company of Boston. Mr. Brooks, on arriving at the Soo, found that his reputation as an inventor had preceded him, and he came very near having to make a speech, but, owing to the absence of his friend Edison and his consequent lonely feeling, he escaped.

Mrs. Hill accompanied the energetic western manager of the Bryan-Marsh company. Mr. Hill certainly deserves the credit for having carried to a successful conclusion what was really a gigantic undertaking for so young an association as the Northwestern. Too much cannot be said of the delights of the trip, which he so carefully planned and so conscientiously carried to a successful finish.

Electrical Engineer B. J. Arnold succeeded in reaching Chicago in time to meet Mrs. Arnold and catch the boat. Mr. Arnold is one of the hardest workers among the electrical men in the West, and the engineering work on his new St. Louis central station has occupied his time so closely that it was feared he might not be able to attend the convention. He had a royal good time, though, as did Mrs. Arnold, and was apparently well repaid for his time.

The Northwestern Electrical association should feel highly complimented at the interest shown by the representatives of both Duluth and West Superior. Mayor Truelson of Duluth and Mayor Dietrich of West Superior met the association at Chicago. Mayor Truelson was accompanied by O. C. Hartland, C. F. Leland, F. L. Taylor, O. H. Simons and H. E. Smith, while Mayor Dietrich of West Superior had with him Mr. Perrin and A. A. Cross.

The meeting of the association on board the steamer Northwest will always occupy a prominent place in the history of the organization. Credit is now freely given to J. M. Hill of Chicago, to whom the association is indebted for one of its most enjoyable conventions. In planning the trip Mr. Hill took cognizance of the fact that the members looked forward to the mid-summer convention rather as a pleasure trip than as one to be devoted entirely to business.

President George A. McKinlock of the Central Electric company was in the party. Mr. McKinlock had looked forward to this trip ever since its inception, and the many friends of his company were glad to welcome him on this, his first Northwestern convention trip. For years Mr. McKinlock, owing to the great pressure of business, has been compelled to delegate a large proportion of the pleasures of such occasions to others, but this time he was on hand, and it is safe to say that it will not be his last trip, as he seemed to enjoy it hugely.

President F. N. Phillips of the American Electrical Works of Providence daily promenaded the deck, arm in arm with the future mayor of Edgewater, Ill. For the benefit of those who are not familiar with Chicago's suburbs, it may be said that Edgewater is a strikingly beautiful place, and one of the most aristocratic neighborhoods in the vicinity. Western Manager F. E. Donohue, for the American Electric Works accompanied Mr. Phillips, who, perhaps for the first time, realized how justly famous has become the Phillips clambake in this part of the country.

The "boiler doctors," Robert F. Carr and Charles S. Kehler, representing the Dearborn Drug and Chemical Works of Chicago, won the hearts of the ladies by the distribution of a souvenir in the shape of a handsome bottle of the well-known Dearborn perfumery. As is well known, the Dearborn company makes a specialty of the analysis of the water of steam boilers, and "prescribes" a remedy for scale. This scientific method of boiler treatment is meeting with a phenomenal success and is especially appreciated by electric-light men. President Edgar sent regrets to his many friends of the Northwestern association.

Proprietor Frank Taylor of the Spalding Hotel, a picture of which is presented herewith, is a genius in his line, and he deserved the handsome recognition of his enterprise that he received from the delegates. Mr. Spalding came all the way to Chicago to go up on the boat and make the acquaintane of the jolly party, and it was unanimously voted that the convention make headquarters at his hotel; it is needless to say that no mistake was made. In fact, henceforth the Spalding will be likely to catch every electrical man that passes through that territory. Mr. Taylor was indefatigable in his efforts to attend to the comforts of everyone that visited his house.

To say that Secretary Mercein was indispensable would be only to repeat an expression that has been current year after year, for the reason that it has been a hard-earned, yet entirely unsought-for, compliment. From the start Mr. Morcein proved himself, as has always been the case, the life of the party. Wherever a strong voice, a well-turned speech or an announcement was required, there was a cry of "Where's Mercein?" At the first evening meeting on the Northwest, at the gathering at Sault Ste. Marie, in the parlor entertainments on the boat, and last, but not least, in all matters of business and comfort, Mr. Mercein was the man of the moment.

Chicago Edison Company.

Stockholders of the Chicago Edison company held their annual meeting on Monday, June 13th, and decided to reduce the number of the company's directors from 13 to 11. This action was suggested by the withdrawal of Col. R. C. Clowry, who resigned last fall, and the request of J. W. Doane that he be relieved of the duties of director, because of the fact that other business required the whole of his attention.

Edward L. Brewster, F. S. Gorton, Samuel Insull, R. T. Lincoln, Joseph Leiter, J. J. Mitchell, Erskine M. Phelps, Byron L. Smith, A. A. Sprague, A. F. Seeberger and Lambert Tree were elected directors for the ensuing year.

Among the statements given to stockholders was an interesting table which shows the growth of the company's business during the last five years by giving the equivalent of 16 candle power lamps connected at the end of each fiscal year:

March 31, 1894	238,124
March 31, 1895	272,410
March 31, 1896	315,732
March 31, 1897	355,140
March 31, 1898	436,083

Victory for Trolley.

The Chicago City Railway company has gained a victory over Montgomery Ward, who attempted to prevent the introduction of a trolley line on Michigan avenue, between Madison and Randolph streets. Last Monday Judge Ball vacated the temporary injunction granted by Judge Brentano. The street-railway company anticipated Judge Ball's decision, and the officials were in readiness to get their cars running by trolley over the disputed territory before any other court could issue another injunction. The block in front of Ward's property was quickly set with poles, and 12 men on a trolley wagon were soon stringing the wires. Superintendent Nagle urged the men to make haste, fearing that at every moment a deputy sheriff would appear and serve an injunction. In exactly 1½ hours from the time the trolley gangs received orders to begin the work Superintendent Nagle gave the signal for the first car to pass over the disputed territory with electric power. The erection of this trolley line completes the downtown loop of the Wabash avenue feeder line. Mayor Harrison granted the railway company permission to erect a temporary trolley loop over these streets during the track-elevation work at Sixteenth and Clark streets.

CORRESPONDENCE.

Northwestern Notations.

Minneapolis, June 13.—Efforts are being made at Brainerd, Minn., to consolidate the street-car, electric-light and telephone systems, and utilize power from a dam to be constructed across the Mississippi River. As things now stand, none of them are profitable investments.

J. C. Hubinger of Keokuk, Ia., has been granted franchises at Quincy, Ill., for a gas and steam-heating plant, an electric-light plant and a street-car system.

L. S. Cass and J. H. Rafferty of the Rapid Transit company, Waterloo, Ia., are interested in a project to build an electric railway from Colesburg to Manchester, Ia. The projected line would be 24 miles long and would run through a prosperous country.

Litchfield, Minn., needs a heavier dynamo for its electric-light plant than it has, as the present one is very much overloaded. Since New Painesville has voted for an electric system, there is talk of selling the present Litchfield dynamo to New Painesville and getting a larger one.

Mr. Gottfried, a Chicago capitalist, is putting in a $15,000 electric-light plant at Elkhart Lake, Wis. The latest and most improved machinery is being used.

The city of Elmo, Ia., will vote June 20th on establishing an electric-light plant.

The Fort Wayne Electric corporation is sounding sentiment at Barron, Wis., with a view to establishing an electric-light plant there.

R. L. Daniel of Moorhead, Minn., has gone to White Sulphur Springs, Mont., to take charge of a 500-light electric plant.

The light committee of the Duluth, Minn., City Council will recommend cutting off 200 lights from the streets, which will mean a saving to the city of $22,000 per annum.

J. W. Petersen, superintendent of the electric-light plant at Fergus Falls, Minn., petitioned the council to increase his salary. He stated that he went in when there were but 500 lights and received $74 a month and $6 for the use of his horse. Now there are 2,700 lights. The council granted the petition.

The street-car company in Des Moines, Ia., is figuring on building a line down Fifth street from an intersection with the Court avenue line, across the new Fifth street bridge, and thence east to an intersection with its South Des Moines and Sebastopol line.

H. E. Chase, superintendent of the electric-light plant of Eldora, Ia., has been appointed to a position with the Hartman Insurance company. The council of Duluth, Minn., has appointed a commission to secure from the Hartman Electric company a price at which it will sell its plant, and also to ascertain the cost of paralleling the plant.

A stock company has been formed at Duluth, Minn., to use the Edison patent electrical ore separator in the states of Minnesota, Wisconsin and Michigan. The magnetic ores of Cook county, which are now valueless, are to be used, and the power is to be developed from the St. Louis River water power.

The council of Winnebago City, Minn., has voted that it is the sense of the council that the village be lighted by electricity. The recorder has been instructed to inspect plants and systems and report.

J. G. Robertson of St. Paul secured the contract at Rochester, Minn., to enlarge the city light plant, for $7,796.

Electric wiring is to be regulated in Des Moines, Ia., in the future. The superintendent of street lights will have that duty added to his other work.

W. D. Meservey of Fort Dodge, Ia., has taken the position as superintendent of the electric-lighting plant at the state penitentiary at Anamosa, Ia.

The Bigelow Electric company was awarded the contract to put in an electric-lighting plant for the city of Neola, Ia., for $5,518.

The electric light plant at Mitchell, S. D., was burned, with a loss of $5,000; it was uninsured. M. B. Cleminger, the owner, will rebuild.

The Ottumwa Electric Railway and Power company's plant at Ottumwa, Ia., was sold by the master in chancery to E. E. McElroy, trustee for the bondholders, for $190,000. The plant is said to be worth $500,000.

C. W. McElyea has passed a deed transferring the street railway of Cedar Falls, Ia., to the Cedar Falls and Normal Railway company for a consideration of $25,000. A mortgage for $10,000 was executed to J. A. Fitchpatrick.

The Chippewa Valley Electric Railroad company has been formed at Eau Claire, Wis., with $200,000 capital stock. It will build an interurban line to Chippewa Falls, for which the survey has been completed, and will eventually own and operate the lines of Chippewa Falls and Eau Claire. C.

PERSONAL.

Cyrus O. Baker, Jr., master of transportation, was elected an honorary member of the National Electric Light association at the Chicago convention.

Charles W. MacCord, Jr., the younger son of Professor MacCord of Stevens Institute of Technology, who died at Auburn, N. Y., from appendicitis, was buried last week at Hoboken. Mr. MacCord was in his twenty-sixth year. He was graduated as a mechanical engineer from Stevens Institute in 1894, and became a contributor to engineering magazines, and much that he wrote attracted attention, particularly a treatise on slide valves, which was published last year. Since last June he had held a responsible place with the firm of McIntosh, Seymour & Co., engine builders, of Auburn, N. Y.

ELECTRIC RAILWAYS.

The Walker company received a telegram from its patent attorneys in New York city on June 11th, announcing that "Judge Shipman has just decided foundation reversible trolley patent in our favor. Bill dismissed with costs."

Workmen are engaged in stringing the cable for the Lima and Honeoye Falls electric railway in New York, and it is expected that in a comparatively short time the electric-railway and lighting systems for the villages mentioned will be in full operation, as the power house is nearly ready for the machinery.

As the outcome of the action brought against the Lock City Electric Railway company by the Mercantile Trust company of New York, to foreclose on $650,000 worth of bonds, which has been sold at the courthouse in Lockport to Frank Haviland of that city for $10,000. Included in the sale are the franchise, rolling stock, poles, wire and cars.

TELEGRAPH.

The Western Union Telegraph company announces that the laying of the new cable between Fort Townsend, Wash., and Victoria, British Columbia, has been completed and that direct telegraphic communication can now be had with Victoria.

Cecil Rhodes recently addressed the African Transcontinental Telegraph company upon the subject of the "Cape to Cairo" telegraph, and expressed his confidence in the "thoroughly practical character of what has been described as a 'imaginative' scheme." He was certain that the line would get through to Cairo, and then, he said, the company would send cable messages from Africa to London. Mr. Rhodes' plans were unanimously indorsed, and the company's capital was largely increased.

POWER TRANSMISSION.

The Niagara Falls Power company is preparing to transmit power to Lockport, a city of 16,000 inhabitants, about 19 miles from Niagara Falls. It is probable that the transmission line will follow the route of the Buffalo and Lockport canal from Tonawanda to the Lock City. If a sufficient number of patrons can be secured, Lockport will enjoy the advantage of Niagara power before next winter. The city has a number of busy mills, the majority of which have been much hampered by the lack of a power supply, as the main source of power has been water from the Erie Canal, a state possession, that is in no way reliable for many months in the year.

The Urban Roller Mills of Buffalo will be operated by electric power transmitted from Niagara Falls. It is expected that the new source of power will be utilized before the end of July. The main motor of the plant will be of 400 horse power, direct connection being made to the present system of shafting, which will be, for the most part, retained. The big motor will run all the machinery of the mill except the machinery of the grain elevator and the machinery in the mill connected therewith. In these latter instances two separate motors will be installed in order to save the long line of shafting required, with its consequent friction and loss of power. The total amount of electrical power to be used in the mill will be very close to 500 horse power. It was expected to have installed the electrical machinery and apparatus long before this, but the demands of the government on the manufacturers of electrical apparatus have caused some little delay.

TECHNICAL SCHOOLS.

The 28th annual commencement exercises of the Worcester Polytechnic Institute will be held on June 19th to 23d. The programme includes a meeting of the Washburn Engineering society in the hall of the engineering laboratory on June 21st, at 8 p. m., and an address by the Hon. H. S. Pritchett, superintendent of the United States Coast and Geodetic Survey, Washington, on "The Engineering Side of Astronomy," on June 23d. The alumni dinner in the engineering laboratory will be held in the evening of the same day.

ELECTRICAL SECURITIES.

The Columbus Street Railroad company reports gross earnings for May of $63,346, an increase of $14,456 as compared with the same month of last year, and net $33,728, an increase of $7,922. For the five months ended May 31st the gross earnings were $297,887, an increase of $86,205 as compared with the corresponding period of last year, and net $138,501, an increase of $18,494.

Directors of the West Side Construction company of Chicago have declared a dividend of 70 per cent., payable on June 27th to stockholders of record of June 20th. The dividend is equal to seven per cent. on the original capital stock of the company, which on March 28th was reduced from $5,363,900 to $536,390. This was done, according to the resolution adopted, in view of the facts that the contract between the company and the Metropolitan "L" road had been completed, and that, the liquidation of the affairs of the company and the distribution of its assets among its shareholders having reached a point where the nominal value of its capital stock was very largely in excess of the value of its remaining assets, the company was thereby subjected to the payment of taxes greatly in excess of those which it fairly and justly should pay. The funds with which to make the $7 per share distribution were acquired a few days ago through the sale by the construction company of its holdings of Union Consolidated Elevated bonds, amounting to $407,000 par value. If the company got par for its bonds, the proceeds of the sale amounted to $70 per share on the outstanding stock. As assets the construction company still owns the Franklin and Market streets real estate, formerly the downtown terminal of the Metropolitan "L," which is valued at $270,000, and the indebtedness of the Metropolitan "L" company in the form of two notes and some past due coupons.

The Chicago Metropolitan Elevated reorganization committee is now at work on a plan for rehabilitating the property, which, it is thought, will be ready for announcement some time in August. The committee has gained what it considers a fairly accurate idea of the earning capacity of the road. It has now been eight months since the opening of the loop. From the records obtained in this period it is estimated that the road is able to earn approximately $450,000 a year net. This exceeds interest requirement on $10,000,000 of four per cent. bonds. At the same time there is a fair margin for increase in traffic and a chance of reducing the operating expenses to an average of 45 per cent. of gross. The plan now being discussed by the reorganization committee contemplates briefly the issue of either $10,000,000 per cent. bonds or $7,500,000 five per cent. bonds. These will be exchanged for the bonds now outstanding at the rate of $667 in new four per cents. or $500 in new five per cents., as may be determined, for each $1,000 principal of the present issue. For the balance of face and accrued interest of old bonds and for assessment on stock, preferred stock or income bonds will be given. The Metropolitan company has outstanding $15,000,000 of five per cent. first-mortgage bonds and $15,000,000 of common stock. Its floating debt is about $800,000, being owed to the West Side Construction company. The stock, in all probability will be assessed between $6 and $8 a share in order to liquidate this indebtedness.

MISCELLANEOUS.

In 1899 the centenary of Volta's discovery of the electric pile is to be celebrated in Como, his native town, by an international exhibition of electrical appliances.

An acetylene-gas explosion occurred at the residence of Dr. Charles Beaver of Mancelona, Mich., a few days ago. The explosion happened while the doctor was engaged in cleaning the generator, and he was severely burned about the face. The damage to the room was slight, as the quantity of gas contained in the generator was very small at the time.

TRADE NEWS.

The Peru Electrical Manufacturing company is sending its patrons souvenir pin-holders of porcelain bearing the company's monogram. It is very neatly gotten up and should prove a useful reminder.

Huebel & Manger are having quite a run on their well-known style "F" skeleton bell. This is used for important signal work on railroads, vessels, etc., and for fire alarms in hotels, schools and factories, and for all purposes where a reliable, loud-ringing bell is required.

The Warren-Medbery company of Sandy Hill, N. Y., is now manufacturing a full line of Medbery switches and switchboards in all sizes, and will shortly be able to supply the market with the celebrated "Medbery insulation" for electric railways, which is so widely and favorably known.

Many of the convention visitors called at the new station of the Chicago City Railway company, which is designed for fifteen Sprague-Sidowatt Walker rope driven generators. The Walker company is now supplying the Brooklyn electric railway with 300 motors of 80 horse power each, and is making a specialty of large motors for heavy interurban traffic.

The Chicago office of the Stilwell Bierce and Smith Vaile company has been removed to 311 Dearborn street. The company is showing a complete line of electric pumps and is meeting with considerable success in selling them. Electrically driven outfits have been supplied to the Apple River Power company of New Richmond, Wis., the

Matthiessen-Hegler Zinc company of La Salle, Ill., and the Choctaw Railway company.

The new power house now being erected by the Port Chester Street Railway company of Port Chester, N. Y., is 45 feet by 84 feet, and consists of a boiler room, engine and dynamo room. The building has brick side walls in which are built steel columns supporting steel truss roof. In the engine room is a traveling crane, arranged so that any part of the engines or dynamos on the floor below can be readily lifted and moved from one place to another. The power house is built in a substantial manner, and is a well-designed modern station in every respect. The steel work for this building was designed and is being erected by the Berlin Iron Bridge company of East Berlin, Conn.

BUSINESS.

The Central Manufacturing company of Chattanooga, Tenn., furnished all the special pins used in the installation of the Lachine Rapids Hydraulic and Land company of Montreal. This plant, which has become well known through the many interesting and unusual features connected with it, was described by Mr. Walbank before the National Electric Light association last week.

Eugene Munsell & Co. and the Mica Insulator company of New York and Chicago were represented at the National Electric Light convention, Chicago, by Charles E. Coleman, manager of the two concerns in the West. The companies' blotters were distributed freely at the writing-rooms and headquarters of the different companies represented at the Auditorium during the convention.

J. Holt Gates & Co., representing the Walker company of Cleveland, the Wagner Electric Manufacturing company of St. Louis and the Card Electric company of Mansfield, O., report the sale last month of 1,900 kilowatts of generators, besides numerous switchboards, street-railway equipment and other electrical details. The Walker, Wagner and Card companies have never before been so busy in their history as at the present time, as they are working their forces day and night.

The Ferracute Machine company of Bridgeton, N. J., manufacturer of presses, dies and other machinery for sheet metal, has for some years been paying special attention to presses and dies for making armature disks and other electrical work, and it has been successful in introducing its machines into the largest factories. The General Electric company has from time to time put in the Ferracute company's large double-crank presses for cutting large disks, and it has now what is probably the finest row of presses of this kind, perhaps, in the world—13 of these presses in a straight line, all running on armature disks and for various other sheet-metal work. The Ferracute company has also placed a number of the large double-crank presses in the works of the Westinghouse Electric company, Walker Manufacturing company, Crocker-Wheeler company, C. & C. company, etc. It has also sent a number of these presses abroad to Germany, England, France and Belgium. This company has also a line of open-front presses for smaller armature disks, a line of punching presses for instrument work and other goods in heavy metals, and a line of double-action or drawing presses for balls, cups, shells, lamp parts, etc. It is just placing on the market a new machine for indexing and notching armature disks, which is adjustable for various sizes of work and for any number of notches, and embodies a number of improvements not found in any other machines now on the market.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 7, 1898

605,067. Electric Switch. Charles C. Badeau, Schenectady, N. Y. Application filed September 17, 1897.

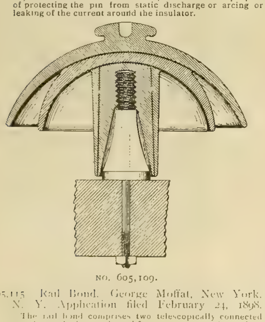
The first claim is given: In an electric switch, the combination of a switchboard, stationary switch members secured to said board, a pivoted switch blade co-operating with said switch members and made from a strip of metal bent lengthwise upon itself, and of substantially uniform width throughout, and a handle secured to the switch blade at the bend.

605,090. Electrical Apparatus for Charging Furnaces. Joseph P. Eck, Muncie, Ind. Application filed August 12, 1897.

This apparatus consists of a charger track adapted to travel across the face of the furnace, a charger frame adapted to run upon the track, a charger bar pivotally suspended within the frame, a rod rotatable in the charging bar, a cam adapted to enter the wall of the charging bar and engage the shank of the pan, means for raising and lowering the outer end of the charger bar, and suitable electric motors in proper circuit for operating the various parts of the apparatus.

605,109. Insulator. Fred M. Locke, Victor, N. Y. Application filed April 23, 1898.

An insulator made of porcelain is constructed of two or more parts fitted one into the other, and secured together, the inner part being provided with a socket by which it is mounted, the inner part or shell extending down to a point adjacent to the cross-arm, forming a sleeve for the purpose of protecting the pin from static discharge or arcing or leaking of the current around the insulator.



NO. 605,109.

605,115. Rail Bond. George Moffat, New York, N. Y. Application filed February 24, 1898.

The rail bond comprises two telescopically connected members, which are adapted for engagement with openings in adjacent rail sections.

605,174. Induction Coil. Adrian L. Bogart, Jamaica, N. Y. Application filed April 22, 1897.

An interrupter is employed having an armature mounted upon a relatively light spring, a second and heavier spring carrying a movable contact point and arranged in the path of movement of the first spring, and a fixed contact point normally making contact with the movable contact point.

605,197. Electrical Valve-controlling Device. Arthur E. Colgate, New York, N. Y. Application filed May 2[illegible], 1896. Renewed April 1, 1898.

An automatic circuit controller for periodically opening and closing the circuit is provided with a magnet for cutting the automatic controller out of circuit and a single hand-operated switch for controlling the operation of the valve at will and also for controlling the operation of the last named magnet to connect or disconnect the automatic controller in circuit.

605,[illegible]. Electric Transformer. John J. Bellman and Charles [illegible] Rittenhouse, New York, N. Y. Application filed June [illegible], 189[illegible].

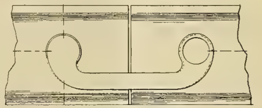
The ferro-magnetic [illegible] of integral plates so mortised that when the [illegible] properly assembled the core of the magnetic field will be approximately circular in cross-section.

605,211. Trolley Switch. Jacob H. Vanasdel[illegible], Seattle, Wash. Application filed October [illegible], 1897.

A suitably supported switch plate is provided with a keeper, a guide is arranged at the under side of the plate, a movable, spring-pressed switch point is arranged at the under side of the switch plate and normally bearing against the guide, and a latch is also arranged at the under side of the plate and connected with the switch point and adapted to engage the keeper and hold the switch point away from the guide.

605,228. Electric Arc Lamp. William Hochhausen, Brooklyn, N. Y. Application filed January 22, 1897.

There is the casing containing the operating mechanism in combination with a vertical partition dividing the space inclosed by the casing into two chambers, one of them containing the mechanism to which access must be had in trimming, and means for gaining ready access to the chamber from the exterior without opening into the other chamber.



NO. 605,115.

605,251. Trolley-wire Hanger. George E. Johnson, Los Angeles, Cal. Application filed August 19, 1896. Renewed July 22, 1897.

Features of this device include an interiorly screw-threaded cap, a plug of insulating material exteriorly screw-threaded and screwed into the cap, a trolley wire hanger having its stud secured in the plug, the rim of the cap being beveled outward and downward away from the plug to form a drip edge.

605,256. Insulator. Ralph D. Mershon, Colorado Springs, Colo. Application filed February 14, 1898.

An insulator for high-tension circuits having a long, tubular petticoat adjacent to the supporting pin and a short outer petticoat of much greater diameter, the edge of which is approximately the same striking distance from the cross-arm and the supporting pin.

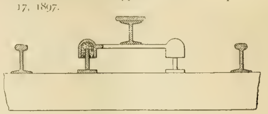
605,260. Mounting for Third Rails. Sidney H. Short, Cleveland, Ohio. Application filed November 5, 1897.

A supporting bar for a third or contact rail having inverted bell or cup-shaped castings arranged to project from the ends and on the same side thereof, insulating material arranged in the castings, and supporting standards arranged to be received in the insulating material.

605,261. Third Rail for Electric Railways. Sidney H. Short, Cleveland, Ohio. Application filed November 5, 1897.

A bar is supported by, but insulated from, the standards, a third or contact rail is supported upon the bar, the rail presenting a side surface for contact with the shoe or collector, and a strip or plate laid lengthwise upon the rail and extending over the top edges thereof.

605,279. Safety Lock for Incandescent Lamps. Ernst Faller and Herrmann Herbstritt, San Francisco, Cal. Application filed September 17, 1897.



NO. 605,261.

In an incandescent light, a globe having a metallic screw-threaded end or base, the permanent fixture having the corresponding screw-threaded portion into which the globe portion is adapted to interlock, a shoulder or catch formed upon the entering interlocking portion, and an elastic automatically engaging tongue projecting inwardly from the other portion of the fixture so that it can only be reached from the interior of the end or base whereby the two are engaged and permanently locked when the globe is in position for operation.

605,294. Telephone Holder. Jehiel T. Moore, Minneapolis, Minn. Application filed August 24, 1897.

The pivotally supported lever has a balance weight on one end and a telephone receiver clasp on the other end, with a telephone switch operating connection.

605,304. Controller. Thorsten von Zweigbergk, Cleveland, Ohio. Application filed February 23, 1898.

In a controller there is the combination with the controller shaft of a collar tightly surrounding the shaft and a trough below the collar and adapted to receive water passing from it and convey it beyond the controller.

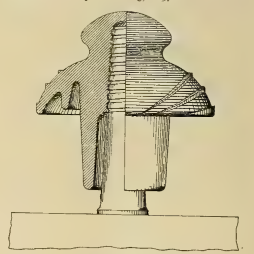
605,317. Electric-railway System. William Lawrence, New York, N. Y. Application filed December 1, 1897.

A junction box for surface contact railways is provided with a seat at one side for the surface contact, a cover plate alongside thereof, and having a removable secondary switch box within the junction box, a shaft within the secondary switch box carrying a switch, and extending out across the junction box and carrying an armature.

605,326. Trolley Connection for Electric Cars. John G. McLaughlin, Brooklyn, N. Y. Application filed December 28, 1897.

The first claim is for the combination of the trolley pole, the swinging frame having cheeks extending upward above and beyond the extremity of the trolley pole, and the wheel mounted between the upwardly projecting cheeks of the swinging frame.

605,341. Telephone System. Robert T. Reid and James L. McDonnell, Tacoma, Wash. Application filed September 25, 1897.



NO. 605,256.

This arrangement includes the combination with the conductors of a party line, a series of telephones arranged in parallel between the conductors, a switch arm for each multiple arc telephone circuit, an electromagnet, a polarized armature for the magnet, an arm on the armature normally disposed under one end of the switch arm and a circuit in parallel with the telephone circuit and including the electromagnet, the arm on the armature thereof and the switch arm.

605,345. Call-box System. Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash. Application filed June 22, 1897.

A messenger call system is described, comprising main wires, a battery in the main wires for operating all the call boxes, an ordinary call-box circuit, normally closed contact figures arranged in circuit, an auxiliary circuit comprising a resistance and transmitter, and means for connecting the auxiliary circuit with the main-line wires.

605,358. Signal Device. Frank B. Taylor, Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash. Application filed July 23, 1897.

A controlling device for an electric circuit is employed, comprising a wheel having a number of stop pins, an armature lever adapted to engage with the respective stop pins, an electromagnet located in a main circuit and co-acting with the armature lever, a local circuit in which the armature lever is comprised and for which it serves as a circuit-closer, and a motor in the local circuit for operating the wheel.

605,424. Connector for Storage-battery Plates. Gilbert Hart, Detroit, Mich. Application filed January 13, 1898.

An insulating base bar is employed, together with a lead or metallic plate superimposed upon the base bar, connector plates alternately extending in opposite directions and resting at one end upon the lead or metallic plate, and screws passing through the connector plates and the superimposed lead or metallic plate into the insulating base bar.

Western Electrician.
EVERY SATURDAY.
Vol. XXII. CHICAGO, JUNE 25, 1898. No. 26

Enlarging the Power Plants of Niagara.

By Orrin E. Dunlap.

The first turbine and generator installed in the extension of the Niagara Falls Hydraulic Power and Manufacturing company's power station are now in operation. The turbine is the first of five which are to have place in the new building. It was built by R. D. Wood & Co. of Philadelphia, and in general appearance resembles somewhat the turbines installed in the original section of the station. It has a capacity of 2,500 horse power, and it has been given position over the last of the five valves of the penstock that is nearest the outside wall of the power station. The wheel is of the Jonval- a pair of 24-inch I-beams. The weight of the bronze wheels is 5,095 pounds. They are located in the draft tubes, one on each side of the casing proper, on horizontal axis, and directly connected to the generator. This shaft is supported by a rigid bearing. The disk that forms part of the flush bearings is keyed to the shaft and adjusted by four heavy set-screws, one on each side of the shaft, to take up the thrust. The wheels discharge laterally into the discharge or receiving pipes. The casing is stiffened by four 2¾-inch rods, which extend through it. In designing this turbine special provision was made for the great pressure on the component parts, and especially on the gates, which were planned on a slide-motion principle and counterbalanced, this been installed, the other being in course of construction. The generator now in place will supply current for the operation of the new plant of the National Electrolytic company in the manufacture of chlorate of potash, and was made by the General Electric company. The machine has 14 poles and will make 250 revolutions per minute. Its output is about 5,000 amperes at 175 volts, or a capacity of 875 kilowatts, nearly 1,200 horse power. It is of large type, and direct-connected to the turbine. In its construction consideration was shown for the fact that it would be called upon to do the severe work of the electrolytic process, which requires practically a continuous service. The National Electrolytic company's plant is located on the high bank

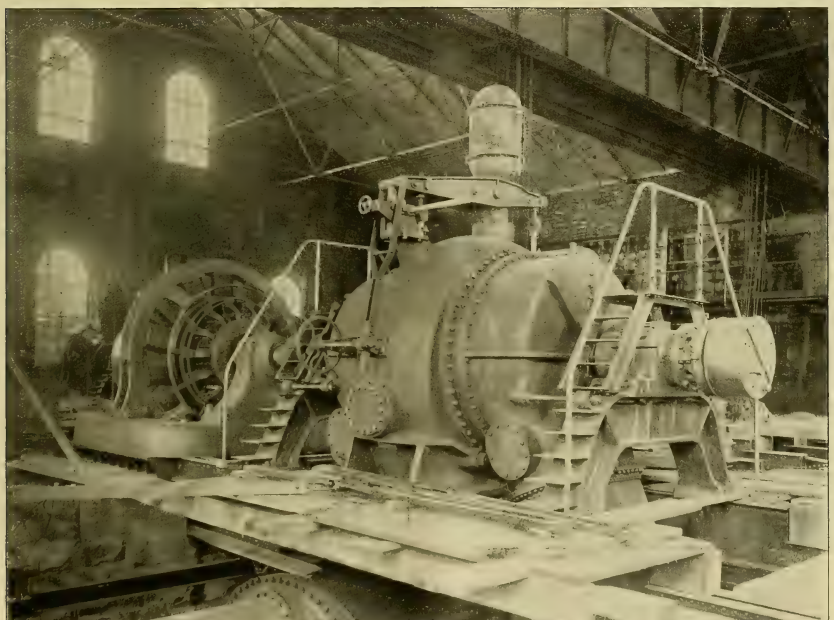


FIG. 1. ENLARGING THE POWER PLANTS OF NIAGARA.—DIRECT-CONNECTED TURBINE AND GENERATOR.

Geyelin improved type, and in construction closely resembles the six wheels made by the same firm for the Niagara Falls Paper company. However, the head under which the wheels are operated has made some slight changes necessary. The head at the paper mill is only 140 feet as against 210 feet in the power house of the Niagara Falls Hydraulic Power and Manufacturing company. The turbine has a large circular casing in which the wheels proper are located. The water is admitted underneath and flows upward to the guide wheels through a gate and then to the runners. From the sides of the casing discharge pipes project laterally and then downwardly, draft tubes 22 feet eight inches long being attached, thus utilizing, in part, the atmospheric pressure. The heads of the large casings are more oval and not quite so high as the casings about the wheels in the first section of the power house. They are made of cast iron 1⅞ inches thick and have heavy 2½ by six-inch ribs at the bottom. The weight of the casing is about 10 tons, while the total weight of the wheel is about 21 tons. It stands upon ing a simple but effective method of overcoming the enormous pressure which would act on each individual turbine gate. The gate is of the ring pattern, is operated by a walking beam, which works over the top of the casing proper, and is connected to the beam by steel gate rods 2½ inches in diameter, which extend down through glands into the casing. Cast-steel brackets are riveted to the gate, and to these the gate rods are connected. The runner has 34 buckets, with a total area of 140.25 square inches, while the guide wheel has 29 buckets and a total area of 140.53 square inches. Over the walking beam there arises an air cylinder about 30 inches high and having an inside diameter of 20½ inches. On this turbine provision has been made for disconnecting the governor by simply operating a wheel, which unscrews a rack. The Reynolds governor is attached. The turbine was installed under the supervision of E. H. Broome, the Niagara Falls representative of the makers.

While it is intended that this turbine shall operate two generators, only one of them has so far above, adjoining the Cliff Paper company's mill. It is a story-and-a-half brick building, with basement. The success met with in transmitting current from the original installation to the lower works of the Pittsburg Reduction company over aluminum cables has led the Niagara Falls Hydraulic Power and Manufacturing company to install aluminum cables to carry current from the new generator to the National Electrolytic company's factory. The lower portion of these conductors will be in bar form, while the upper part will be made after the manner of well-insulated copper cables. This will be the first conductor of the kind placed in service.

The second generator to be attached to this turbine will be the largest machine in the station. It will form a part of the equipment of the Buffalo and Niagara Falls Electric Light and Power company, and when it is in operation it will allow of the removal of the machines of the company, now located in the basement of the Cliff paper mill, to the lighting station on Fourteenth street. The Buffalo and Niagara Falls Electric Light and Power company

is a patron of both power companies at the Falls. The new generator is being made by the Walker company of Cleveland, O. It will be an alternating-current dynamo of 700 kilowatts output capacity, at 2,200 volts pressure, 125 cycles per second, when operated at 250 revolutions per minute. The contract calls for the installation of a continuous-current exciter of sufficient capacity to supply current to the fields of the dynamo to permit of its producing 1,100 kilowatts at its standard voltage, should such be required for a short time. The switchboard to be installed with this machine will be of blue Vermont marble, furnished with all necessary instruments and appliances. The manager of this company is Frank G. Lott, who is also electrical superintendent of the Niagara Falls Hydraulic Power and Manufacturing company.

The penstock which furnishes the water for the new installation is said to be the largest ever erected. It is a little over 11 feet in diameter, and was made by Struthers, Wells & Co. of Warren, Pa. The steel of which it is made varies from five-sixteenths to 1⅛ inches in thickness. It leaves the forebay in an elliptical bell-mouth about 20 by 11 feet in size. For a distance of 60 feet it extends out horizontally, be about the same style as those in the original installation, a slight improvement having been made by Chief Engineer Johnson to provide for the removal of slush ice. A series of racks screens the water before it is allowed to pass into the penstock, thus removing all floating substances likely to injure the wheels. The forebay has been extended in the rear of the lower works of the Pittsburg Reduction company, and the walls were built of concrete. A second canal to connect the forebay with the canal basin is in course of construction, and will run along the south side of the aluminum plant. The walls are also built of concrete. It is expected that enough water will flow from the canal basin to the forebay through the first connecting canal to supply the turbines now in operation, but as more turbines are installed, a larger water supply will have to be provided. The present dimensions of the power house are 100 by 120 feet, and there is ample room on the south side of the building for another addition the same size as that just finished. Access to the power house is now had by way of the elevator in the Cliff paper mill.

In the accompanying illustrations will be found interesting views of the machinery employed and the progress made in the improvements. Fig. 1 shows the new 2,500 horse power turbine and connected generator, Fig. 2 the new penstock and Fig. 3 graphically illustrates the placing of the penstock in the tailrace. The lower end of the penstock is shown in Fig. 4 and the frame of the new gate house over the forebay in Fig. 5. This picture also shows the concrete walls of the new canal. The interesting process of lowering an armature over the Niagara cliff is photographically reproduced in Fig. 6. The general view presented in Fig. 7, showing the addition to the power house in the gorge, penstock, etc., gives an excellent idea of the location and surroundings. The section of the building with the ventilator on the roof is the new part. The work is attracting much attention among engineers throughout the country.

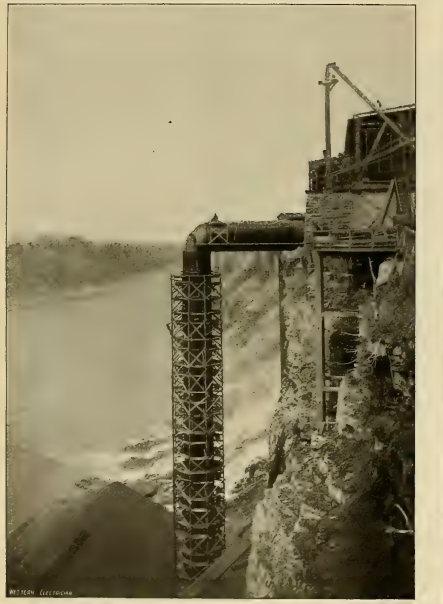


Fig 2 New Penstock.

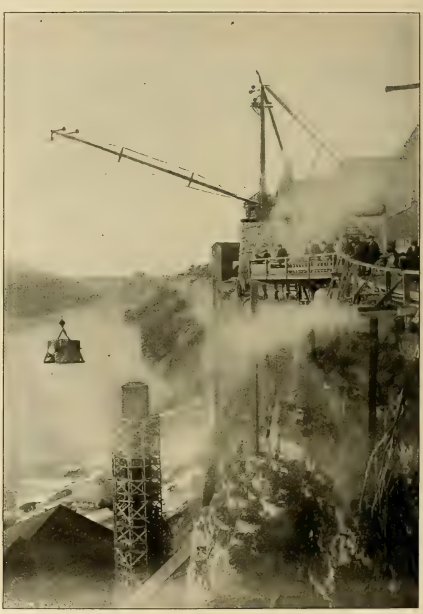


Fig 6. Lowering an Armature over Niagara Cliff.

ENLARGING THE POWER PLANTS OF NIAGARA.

supported on two huge iron girders. Then it drops vertically 200 feet to the power house at the waters edge in the gorge. As will be seen by the illustration, it stands out from the cliff in column-form, while the old penstock hugs the cliff in its descent to the station. The new method of erection is an idea of Wallace C. Johnson, who is chief engineer of the Niagara Falls Hydraulic Power and Manufacturing company as well as president of the Engineers' Society of Western New York. All the work of the company is done under the supervision of Mr. Johnson, and he has made several notable improvements in the new installation, as compared with the old. As the penstock passes under the power-house floor it enters the tailrace, in which it is supported on a series of posts and beams, all made adjustable by a series of keys, the work of the Variety Iron Works of Cleveland, O. For a distance of 50 feet under the floor the penstock has a diameter of 13 feet. It then reduces until it is about seven feet, finally tapering to one 18 inches in diameter and ending in an air chamber 15 feet high and four feet in diameter. Along its course there are five 60 inch valves for supplying water to turbines. The tailrace of the new section of the plant is a little larger than the first tailrace, and is most substantially built.

The gate house over the forebay is of steel frame, covered with corrugated iron. The gates used will

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The West Kootenay Power and Light company is rapidly completing its power plant at Bennington Falls. The poles are set and two wires are stretched between the Falls and Rossland, a distance of 31 miles. The line goes into Rossland over the Montezuma Mountain, and it is the intention of the company to erect another circuit, so that in case of accident there will be no interruption of the current. The first cost of the plant is placed at $125,000, but it is said that the expenditure upon it may be extended to $500,000.

Analysis of the Cost of the Generation and Distribution of a Unit of Electricity.[1]

By Calvin W. Rice

The speaker has been asked at short notice to give this paper, which, considering the nature of the question, should have several months' labor for its preparation. Consequently no original work could be attempted.

I am fully aware of the responsibility of undertaking such a discussion, and therefore will confine the paper to a resume of the most reliable data which can be secured from literature by recognized authorities during the last few years.

It is the intent of the paper to show what has been done, what is being done, and what is therefore possible, rather than to give theoretical tables. It is the intent also to show the advantage of watching each one of the various items which go to make up the total cost, and, by pointing out the proportions of each to the whole, to aid one in the discovery as to which particular items are disproportionately large in his plant.

Before taking up the consideration of the cost of operation of a plant we should first consider the plant itself.

Total Investment Per Kilowatt.

In America the variation in the investment per kilowatt is $200 to $750 per kilowatt capacity installed. In a few cases the figure is below $200, and in a few as high as $1,000; but in the great majority of cases the cost is below $400.

In this respect American practice is ahead of that of Great Britain and the continent, where the majority of plants have a total investment of over $500 per kilowatt installed.

Later in this paper are given figures on some railway plants in Chicago costing less than $75 per kilowatt. I think these figures refer to stations alone, whereas the corresponding values for lighting plants include distributing systems also.

The importance of keeping down the investment per kilowatt need not be emphasized.

The principal items that go to make up the total investment are real estate, steam or water power plant, electric plant, distributing system and minor details.

In the first item we naturally find a great variation in the different plants. In country towns it runs as low as $25 per kilowatt, and in cities as high as $150

1. Read before the National Electric Light association, at Chicago, June 7, 1898.

and over. In other words, there are some plants where the investment in real estate alone is greater per kilowatt than the entire investment is in others.

The investment in steam plant varies from $20 to $60, with figures on the electric plant slightly greater.

It is needless to say that the location of the plant ought to be considered with reference to all influences, each considered separately and reduced to a common method of comparison, that is, the dollars and cents value per year of each consideration.

For instance, in a large city which I visited a couple of weeks ago I observed a new station being erected not over 1,000 feet from a river, yet five or six 1,000 horse power, non-condensing engines were being installed. It is reasonable to assume that the convenience of that site to the main street of the city had a greater dollars and cents value than the consideration of condensing plus the difference in value of the land, as the company had the option to sell the present power site to the government and to buy a river site for less money.

In buying the steam and electric plant, however, it is essential to consider reliability above every other consideration. In emphasizing this point, to make it the end sought while considering the merits of boilers, engines, water-wheels or generators, it should be viewed in its broadest sense. It is of assistance in examining bids on electrical aparatus or engines, to compare the prices per pound, and weight in pounds per kilowatt or horse power, and in considering boilers, heating surface and pounds per horse power, as well as price per pound.

The various methods of rating aparatus and of stating ability to stand overloads are very confusing to the purchaser, and comparison by pounds develops features not otherwise noticed, but worth considering carefully.

Having decided whether or not it is economical

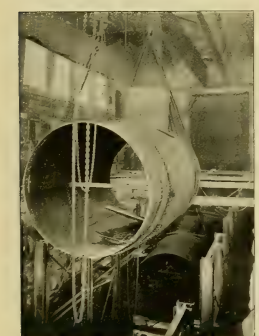


FIG. 3 ENLARGING THE POWER PLANTS OF NIAGARA.—PLACING PENSTOCK IN TAIL RACE.

to use simple, compound or condensing engines, decision as to the boiler pressure will follow as a matter of necessity, and will in turn decide in part whether return tubular or water-tube boilers will be advisable. The price per horse power of boilers is now not widely different.

The advantage of direct connecting over belt or rope drive is now recognized, so very little need be said. The amount of saving has been very carefully sought by Mr. Crompton, and in 23 of the largest English works the results have been tabulated, showing that the cost of fuel averages 46 per cent. higher where the dynamos are rope-driven than where the dynamos are direct-driven by high-speed engines.

Great stress is nowadays put upon high efficiency, and, while this is important, reliability should be the principal feature.

In the present day of good design there is at best little to be gained in absolute efficiency but the cost of energy, and the popularity of electric light and power will be very much affected, according as it is reliable.

Good regulation in the station is more important than high efficiency. Good regulation in the station means ability to use high-efficiency lamps.

The use of 50-watt instead of 58-watt lamps means a saving of 14 per cent. directly in the lamps and in the copper losses. Relatively this increase in efficiency is much greater than is possible in any of the various types of boilers, engines or generators. Therefore the governing of the engine from no load to full load, and the regulation of the generators with load thrown off and on, should be carefully determined.

The value of accessories in the reliability of the plant and the reduction of labor and attendance is important. These accessories are as follows:

I. Feed-water appliances:
(a) Injectors.
(b) Steam pumps.
(c) Electric pumps.

II. Boiler appliances (steam or electric):
(a) Forced draught.
(b) Mechanical stokers.
(c) Super-heaters.
(d) Coal handling and storage.
(e) Ash conveyors.

III. Cranes:
Mechanical or electrical.

IV. Auxiliary electric apparatus:
(a) Boosters.
(b) Station motors.

It is not advisable to drive the exciters from a motor taking current from the main generators, on account of fluctuations being multiplied, but under

FIG. 5. ENLARGING THE POWER PLANTS OF NIAGARA.—GATE HOUSE OVER FOREBOY.

certain conditions the feed pumps, coal and ash handlers, overhead cranes and stokers may be driven with success and economy by either alternating or direct-current electric motors.

Electricity as delivered at the switchboards is generated with economy and can be used more advantageously than steam. The inefficiency of steam is illustrated in the following table, showing the indicated horse power and steam per indicated horse power of some of the auxiliary apparatus of the U. S. S. Minneapolis.

Name of Auxiliary.	I.H.P.	Steam per I.H.P.
Pump of starboard condenser	1.23	266
Circulating-pump engine	19	55
Starboard air pump	6.5	183
Center air pump	25	78
Vertical duplex fire pump	1	205
Horizontal duplex fire pump	0.8	319
Same pump	0.4	150
Vertical duplex bilge pump	2.5	171
Fireroom feed pump	8.8	91
Same pump	1.6	243
Forced-draft blower engine	16.	77
Single-cylinder horizontal flushing pump.	1.4	194
An ice machine	6	70

DISTRIBUTION SYSTEM.

From the station let us go to the cost of the distributing system, which is now becoming an enormous item of expense, since underground conduits are required in many places. The cost of underground construction complete is about four times that of overhead construction.

In the choice of duct and insulation on conductors, again let me emphasize the importance of reliability. With such an enormous investment it is almost out of the question to consider material liable to break down.

In the tests which should be required of the cable two important features should be made prominent. First, the testing apparatus should be at least 50-kilowatt capacity. The seven and eight-kilowatt testing transformers, which up to within a few years were considered sufficient, were a delusion. When it is stated that a cable must stand a test pressure it should be required that that test pressure be maintained at least one hour, as the momentary test is not sufficient to develop faults. Make the insulation-resistence requirements moderate, but insist that the test pressure from a large transformer be maintained

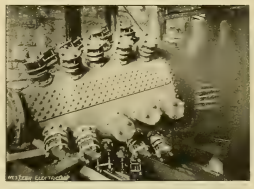


FIG. 4. ENLARGING THE POWER PLANTS OF NIAGARA.—LOWER END OF PENSTOCK.

one hour. In the matter of joints employ only the most skilled labor.

PLANT MANAGEMENT.

Total cost or price.	Generation and Distribution	(a) Material	(1) Fuel (2) Water (3) Supplies
		(b) Labor.	(4) Wages (5) Superintendence
	II. Maintenance		(6) Material (7) Wages (8) Superintendence
	III Management		(9) Directors (10) Salaries (11) Expenses
	IV. Profit		(12) Per cent. on capital.

The cost per unit in what follows refers to 1,000 watts maintained one hour.

The price charged per unit is made up of cost and profit.

The cost may be subdivided as to

I. Generation and distribution; II. Maintenance; and III., Management.

I. Generation and distribution may be divided into

FIG. 7. ENLARGING THE POWER PLANTS OF NIAGARA.—VIEW OF POWER HOUSE IN GORGE.

The use of an oil-distributing system reduces the amount of oil consumed and the attendance required. The air-blast for cleaning around the generators is a great assistance; it saves time, labor, and acts as an insurances against burn-out. This apparatus can now be bought in a combined form, so that the same air compressor and tanks furnish air for the oil circulation and for cleaning.

(a) material and (b) labor; (a) representing (1) fuel, (2) water and (3) supplies; (b) representing (3) wages and (4) superintendence.

II. Maintenance is made of (5) material, (6) wages and (7) superintendence.

III. Management may be subdivided as to (9) directors, (10) salaries and (11) expenses.

As we compared total cost of plant per kilowatt

and found it on the average to be under $400, calculations as to cost of operation of plant per unit output per year give that figure to be, on the average, under 50 cents. That is, on the average, it requires 50 cents' worth of plant to generate and distribute one kilowatt-hour per year.

Load Factor

This immediately develops an important point, namely, load-factor. This feature has been brought out with advantage by Mr. Hammond from data of the English companies. Such data are not obtainable in America, so I quote from Mr. Hammond's paper:

"Former writers have not failed to dwell upon the marked effect which the load-factor has upon the costs of production, and in my estimation of the influences which bear upon that problem I place load-factor directly after output. Without the latter the most favorable load-factor is useless, but, combined with a healthy output, a favorable load-factor greatly reduces costs.

"So convinced is Mr. Arthur Wright of the importance of load-factor that he offers to supply all his customers at three cents per unit for any consumption beyond an average of one hour per day of their maximum demand throughout the year.

"I use 'load-factor' in the sense of the ratio of the actual units generated to the product of the maximum of the year and the total hours of the year; the 'load-factor,' therefore, of 1896, being obtained by multiplying the maximum load of 1896 by 8,784 (i. e., 366 days by 24 hours), and of 1897 by 8,760.

"Though it appears to be the custom at every works to record the maximum load, the 'units generated' are in the majority not arrived at by meter, but by calculation, and in some by a process which one of my correspondents describes as 'cooking.'"

There is another point to be learned, namely, the percentage of units generated which are unaccounted for. This percentage is even greater in gas companies, and it is interesting to watch the reports from year to year, and to see the improvement in this matter. The Massachusetts report of all the gas companies of that state, gives the exact number of feet unaccounted for in each company. These items, added together, in 1897 amounted to 285 million feet. One gas company lost 36 per cent. of its output, and quite a number over 20 per cent.

The largest percentage of unaccounted-for units in the English electric stations generating over a million units appears to be 12½ per cent. Quite a number having an output of 500,000 units have 33 per cent. One station loses 47 per cent.

These figures with respect to electric lighting are not comparable with gas, for the reason that we allow the larger portion of the loss as necessary to the distribution. I have no doubt that a great saving may be made in our stations if attention is brought to this feature.

To go back to the total cost per unit, we find, comparing again the English stations, as I have been unable to obtain such data on American stations:

Total Costs.

Units sold (kilowatt hours) Between	1894 Year of operation	1894 Cost per unit sold (Cents)	1895 Year of operation	1895 Cost per unit sold (Cents)	1896 Year of operation	1896 Cost per unit sold (Cents)
100,000 and 200,000	1st	[illegible]	2nd	[illegible]	3d	[illegible]
200,000 and 350,000	2nd	[illegible]	3d	[illegible]	4th	[illegible]
350,000 and 600,000	3d	[illegible]	2nd	[illegible]	1d	[illegible]
600,000 and 1,000,000	4th	[illegible]	[illegible]	[illegible]	2nd	[illegible]
1,000,000 and 1,500,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,500,000 and 2,000,000	7th	[illegible]	2nd	[illegible]	2nd	[illegible]
2,000,000 and 2,500,000	5th	[illegible]			[illegible]	[illegible]
2,500,000 and [illegible]	6th	[illegible]	[illegible]	[illegible]	3d	[illegible]
3,500,000 and upward.			5th	[illegible]	6th	[illegible]

We find the cost of coal varies from $3 [illegible] to $5 per ton, and yet the cost of fuel per unit has been kept down in a great many plants to one cent. So far as I am advised, there is only one state in our union which gives such data officially, namely, Massachusetts.

A very interesting report of one of the continental plants is that of the polyphase station of the Budapester Allgemeine Electricitats Gesellschaft:[1] "This station has been in operation since 1893. The electric light in Budapest is supplied by two large central stations, one working on the polyphase system and the other on the simple alternating system. The polyphase currents are transformed into continuous current by rotaries to 230 volts on the three-wire system.

"The station consists of six 300-kilowatt, two phase generators driven by triple-expansion engines. The coal is Ostrauer nut and makes 7.4 per cent. refuse. On an average during the winter months the efficiency of the entire system is 67 per cent. The results of the plant are given in the following table:

	1894.	1895.	1896.
Gross production	1,200 000 units	1,900 000	2,800 000
Highest load	15,000 16 c. p. l.	17,000	21,000
Lowest load	2,000 16-c. p. l.	3,000	9,000
Gross watt-hours per lb. of coal	432	575	571

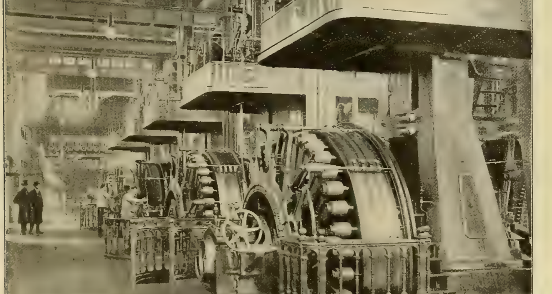
"Consumers pay 50 cents a unit for light and 16 cents for power."

I give below the average cost of coal and contract price per arc lamp per year in about 1,000 stations in the United States.[2] No distinction in price per 2,000 or 1,200 candle power is made in averaging on account of the great variation in price; a 2,000 candle power lamp in one place with high-cost coal sometimes selling for less than a 1,200 candle power with low-price coal.

State.	Hours per year.	Coal per ton.	Contract pr. year.	Price pr. hr.	C. P. pr. Hr. for 1c.
Alabama	4,000	$1 92	$ 89	$.022	791
Arkansas	3,396	2.30	121	.034	390
California	2,885	7.00	120	.045	449
Colorado	3 413	3.18	129	.042	558
Connecticut	2,730	4.28	86	.035	452
Delaware	4,000	2.32	110	.028	728
Dist. of Columbia	4,000	....	106	.027	452
Florida	2,179	Wood	118	.054	222
Georgia	3,424	1.36	84	.034	775
Idaho	4,000	W. P.	114	.028	703
Illinois	2,789	1.19	77	.031	654
Indiana	2,682	1.79	79	.033	634
Iowa	2 870	1.57	86	.032	641
Kansas	2,734	2.02	97	.040	532
Kentucky	3,063	1.20	88	.032	672
Louisiana	4,000	2 38	128	.032	627
Maine	2,629	5.00	67 5	.031	575
Massachusetts	2,705	4.05	93 8	.037	375
Maryland	4,000	3.00	128	.032	626
Michigan	3,465	2.70	77	.024	748
Minnesota	3,133	3 31	98	.036	606
Mississippi	2,179	2.33	102	.047	367
Missouri	2,919	2.51	83	.032	667
Montana	4,000	4.00	131	.033	440
Nebraska	2,891	2.21	109	.041	465
Nevada	3 680	9 50	144	.039	306
New Hampshire	2,583	[illegible]	81 5	.036	444
New Jersey	3,615	2 70	105	.032	611
New Mexico	3,275	[illegible]	123	.045	558
New York	3,387	[illegible]	91	.028	627
North Carolina	2,572	[illegible]	97	.020	521
North Dakota	4,000	[illegible]	120	.030	666
Ohio	3 359	1 56	79	.025	785
Oregon	3,680	W P	128	.035	569
Pennsylvania	3 931	[illegible]	86	.022	869
Rhode Island	2,912	[illegible]	102	.037	459
South Carolina	3,088	2 65	83	.031	501
South Dakota	[illegible]	[illegible]	125	.031	590
Tennessee	4,000	[illegible]	88	.022	765
Texas	[illegible]	[illegible]	109	.037	615
Utah	3,515	2 65	75	.023	872
Vermont	2,251	[illegible]	85	.039	630
Virginia	3,723	[illegible]	76	.022	651
Washington	3,479	[illegible]	128	.039	510
West Virginia	3,089	[illegible]	79	.027	639
Wisconsin	3,057	[illegible]	81	.030	630
Wyoming	3,515	[illegible]	166	.052	352
Total average	3,326	$[illegible]	$101	$.031	580

[illegible] states—1,000 central stations.

1 London Electrician, June [illegible].
2 General Electric Company (Lighting Dept Statistics).



ELECTRICAL ENERGY IN PARIS.—DYNAMO ROOM OF THE JEMMAPES CENTRAL STATION.

Statistics on English Lighting Plants.[1]

	K. W.	Cost plant per K W. installed.	Cost per unit.	Average selling price.
Bristol	945	$517	6.38c	10 62
Brighton	1,200	601	4.72c	9 42
Bradford	1,400	255	4.48c	9 56
Dover	525	270	8 34c	10.76

The highest point for cost of fuel of any of these enterprises was 3.24 cents per kilowatt-hour, and the lowest 1.08 cents; but the conditions are so different that an analysis cannot be made, although the Brighton plant is one which is handicapped.

Railway Plants.[2]—Cost per Unit.

Station.	Boilers.	Pressure.	Style of engines.	Condensing or non condensing	Style of generators.	Coal.	Cost of coal per net ton.	Pounds of coal per unit.	Pounds water per unit.	Cost of coal.	Operating supplies exclusive of coal	Labor operation.	Supplies, maintenance.	Maintenance labor.	Maintenance buildings.	Total.
A	W. T.	160	Cross comp.	C	Direct	Anth.	$2.40	2.60	7.6	$.0028	$.0005	$.0024	$.0003	$.0001	$.0001	$.0061
B	W. T.	160	Trip. exp'n	C	Belt	Bit.	3.50	3.50	9.8	.0052	.0008	.0023	.0006	.0005	.0002	.0096
C	W. T.	160	Cross comp.	C	Belt	Anth.	2.40	3.11	7.7	.0033	.0008	.0044	.0002	.0005	.0001	.0093
D	W. T.	160	Tand. comp.	N	Belt	Anth.	3 15	3.65	9.3	.0051	.0009	.0030	.0001	.0001	....	.0092
E	W. T.	160	Cross comp.	C	Belt	Anth.	2.07	3.50	8.0	.0033	.0010	.0013	.0003	.0006	.0001	.0096
F	W. T.	140	Cross comp.	C	Belt	Cumb. bit.	2.90	3 80	9.3	.0056	......	......	......	......	......	.0100
G	W. T.	140	Cross comp.	C	Belt	Cumb. bit.	3.23	4.00	9.4	.0065	....	......	......	......	......	.0109
H	W. T.	150	Cross comp.	C	Belt	Cumb. bit.	3.05	4.40	8.5	.0068	......	......	......	......	....	.0112
I	W. T.	150	Tand. comp.	C	Direct	Cumb. bit.	2.69	4.20	....	.0050	.0006	.0042	.0002	.0004	.0001	.0105
J	W. T.	160	Vert'l comp.	N	Direct	Bit. scr'ng.	1.40	6.20	6.9	.0057	.0004	.0033	.0004	.0001	.....	.0097
Average			......		....		$2 68	3 90	8 6	$ .0049	$ .0007	$.0034	$ .0003	$.0003	$ .0001	$.0087

A, B, C and E are large stations, containing the most expensive machinery. No expense has been spared in their construction, and in consequence fixed charges are extremely high.

Station D is a representative city station of moderate cost and high efficiency.

Stations F, G and H are city stations of moderate cost. They are not of absolutely modern construction, but at the time of their erection were as perfect as money could make them.

Station I is a model station of small size, running an extremely variable load.

Station J is a large city station running under favorable conditions.

The points of interest in the table are:

First—Cost of coal. This averages one-half cent per unit. This is less than in the ideal station of Mr. Crompton. We get the advantage of cheaper coal in America. The wages item is less in these railway plants than any English lighting station, but it should be remembered that the figures on these railway stations refer probably to generation only.

If we take the pounds of coal per unit and divide 1,000 watt-hours by it, we will obtain 256.

At this point it is interesting to turn back to your 1896 meeting in New York and to the paper by Mr. Swetland, chairman of the committee on data.

From the examination of 81 reports using coal as fuel the average efficiency is 108 hours per pound of coal.

It is interesting to compare these reports with the Budapest Gesellschaft, where the lowest efficiency for the last three years is 432 watt-hours per pound coal, showing there is yet much to be gained.

Below is the report of some of the Chicago railway plants:[3]

Cost of Operating Railway Plants.

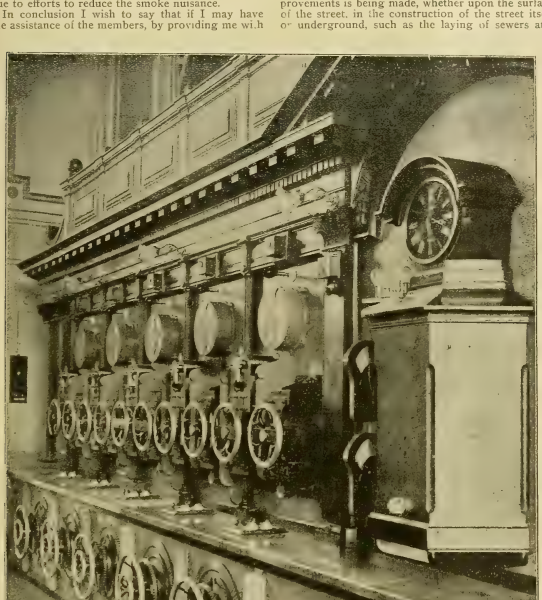
	C. C. Ry. Co. No. 1.	C C. Ry. Co. No. 2.	M.W.S.Sta.
K. W. capacity	$ 5,250	$ 5,280	$ 4,500
Cost per K. W. installed	73.33	75.75	141.33
Cost of station	385,000.00	400 000 00	363,000.00
Units,output per year	1,067,900.	2,375,000	1,460,000.
Fuel per unit	$.0040	$.0039	$ 0033
Water per unit	.0004	.0003	.0001
Labor per unit	.0022	.0007	.0021
Supplies per unit	.0001	.0001	.0004
Total	.0076	.0048	.0059
Interest	.0018	.0008	.0022
Depreciation	.0015	.0007	.0018
Total	.0033	.0015	.0040
Repairs	.00002	.00003	.00003
Total	$.0109	$.0064	$ 0103

A carefully prepared paper by Mr. Horatio A. Foster on the cost of steam power, and read before the American Institute of Electrical Engineers a year ago, emphasizes the fact that there are very little reliable data on American plants. The plants on which tests were made for cost of power were: Two electric lighting stations, one grain elevator, three

1 Electrical Engineer, p. 393, April 14. Claud P. D'Oyly.
2. Street Railway Journal, January, 1897, L. D. Tandy.
3. Street Railway Journal, May, 1897.

waterworks pumping stations, two flour mills, six cotton mills, four newspaper and printing offices, one department store, one furniture manufactory, one bakery, one glazed and fancy paper manufacturing company. By reference to Mr. Foster's report, it will be seen that in rated capacity the plants vary from 40 horse power to 2,500, and in value per rated horse power from $23 to $89 in steam power plants, or as high as $368 in waterworks pumping stations. While the type of boiler used leans largely to the plain, old-fashioned return tubular, with the exception of the cotton mills, the types of engines are almost as varied as the number of plants. In fuel, soft coal or slack of soft coal largely predominates, and a considerable use of mixtures of the latter with dust from the yards and hard-coal slack will also be noticed, which is largely due to efforts to reduce the smoke nuisance.

In conclusion I wish to say that if I may have the assistance of the members, by providing me with data, by next year I can prepare a more helpful paper, going more carefully into the question of calorific value of the different coals used and to the different types of plants.



ELECTRICAL ENERGY IN PARIS.—SWITCHBOARD OF THE JEMMAPES CENTRAL STATION.

DISCUSSION.

President Insull: In connection with Mr. Rice's able paper we have arranged for a discussion on "Prices and Discounts for Electric Current and Methods of Billing Current to Customers," which is so closely interwoven with the subject of Mr. Rice's paper that they might both be discussed together.

Mr. Scovil: In the beginning of Mr. Rice's paper is the following paragraph: "In America the variation in the investment per kilowatt is $200 to $750 per kilowatt capacity installed. In a few cases the figure is below $200, and in a few as high as $1,000, but in the great majority of cases the cost is below $400." I would like to ask what is meant by the word investment?

Mr. Rice: As I understand the data given in the literature which I have quoted, it covers the entire investment of developing waterworks, that is waterworks plant, the steam plant, buildings, real estate, distributing system, whether underground or overhead, clear to the motor or lights in the consumer's plant.

Mr. Scovil: Does it cover royalties?

Mr. Rice: As far as I know it does.

Mr. Ayer: There is a note in the paper where it speaks about the losses or unaccounted watts developed in the lighting station, as compared with gas; I wish to ask Mr. Barker his understanding of it. Is it not a fact that the gas losses are due to condensation quite as much as the watt losses are due to line losses; in other words, are there not in both cases losses in distribution?

Mr. Barker: The occasions for the loss in the gas distribution are largely leakage in the pipe. The matter of condensation loss, if gas is properly made, can be reduced to very low percentage, and the large percentages of loss in cases about which you hear occasionally are due to actual leakage. We always find where a large system of street improvements is being made, whether upon the surface of the street, in the construction of the street itself or underground, such as the laying of sewers and water-pipes or even the laying of underground electric conduits, that the amount of leakage in the gas-pipes and the loss from the amount manufactured is greatly increased.

Mr. Coggeshal: I will state that the loss of output by alternating current from the 1st of January to the 1st of April was 53 per cent.; we collected for 47 per cent. I account for it from the fact that the loss largely existed in the transformers. Our day output is small; we run 24 hours the whole year, and as far as we can indicate it, the loss in the daytime for about eight hours is equal to 24 hours' power, without receipts to amount to anything.

Mr. Wagner: I would suggest that the loss may be accounted for in the fact that the meters do not register the full amount of the current which is used. From my observation I would say that the figures are nearly correct for the usual alternating current stations in small cities. The inefficiency of distribution is rarely much over 50 per cent., the loss aggregates nearly 60 per cent. With a direct current station it is somewhat less.

Mr. Dow: I should like to get a certificate of the accuracy of the statement regarding the Budapest system. It gives the gross watt-hours per pound of

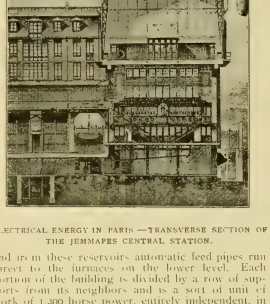
[*Continued on page 387.*]

Electrical Energy in Paris.

The accompanying illustrations give an excellent idea of the electrical station Quay Jemmapes, on the bank of the Saint Martin Canal, Paris, and are reproduced from l'Energie Electrique. The buildings cover a rectangular space of 5,400 square meters. The location is favorable, as the proximity of the canal furnishes easy means of steam condensation and transportation and delivery of the necessary fuel. A boatload of coal per day will be called for when the entire plant is in operation. Twenty-five units of 750 kilowatts, similar to the five already in use, are to be installed.

The main buildings contain the engine and dynamo rooms, shops and accumulator rooms, facing the canal. There is an office and administrative building. The buildings for accessory services occupy the center of the premises and are separated from the former buildings by a street five meters wide. The last group comprises four buildings, extending from front to rear. The first, in front, incloses the elevator pumps and sundry service of the plant; the second contains the water filtering and evaporating apparatus; the third commands the passenger and freight elevators and stairways; the fourth is utilized as a repair shop and a storehouse.

In order to do away with the constant wear and tear, due to trembling where machines are placed above the first floor, broad, massive foundations were sunk below the ground level, and on these were bedded the huge machines, after the manner of similar American installations. But as these required a space of but 14 meters in length, and the dynamos, which are direct-connected, required 17.30 meters, the second floor overhangs the ground floor a sufficient amount to accommodate them, and did not require additional strengthening of the timbers. The coal receptacle, being above also, required an additional support in the way of columns,



ELECTRICAL ENERGY IN PARIS.—TRANSVERSE SECTION OF THE JEMMAPES CENTRAL STATION.

and in these reservoirs automatic feed pipes run direct to the furnaces on the lower level. Each portion of the building is divided by a row of supports from its neighbors and is a sort of unit of work of 1,300 horse power, entirely independent, in every particular, of the rest of the plant.

The two receptacles of each division will store together 140 tons of coal, which, as before stated, is delivered automatically on the fire grates; there are also water reservoirs in each division capable of holding 20 cubic meters of water.

To properly insulate the platform of the generators there are three successive impermeable layers of planking, each independent of the other, and to further augment the safety, the generators are set in iron pans filled with plaster. The cables are brought to the switchboard through a closed subterranean gallery, insulated from the rest of the underground rooms to prevent all possibility of accident. Two canals between the foundation walls and the intermediate walls bring water in for condensing purposes and return this to the outer source when its mission is performed. That which supplies the condensers has a diameter of 1.10 meters, leading from the Canal Saint Martin, while the return is effected through two branches of .9 of a meter each in diameter.

Four boilers form a battery serving one group of engines and dynamos. These four boilers are rated to furnish 10,000 kilograms per hour, and, with the coal commonly used in the Parisian stations. The grate surface is 5.23 square meters, or 56.92 square meters for each battery of four boilers, and the heating surface is 865.52 square meters for boilers, steam dryers and reheaters. The engines have cylinders of 805 millimeters diameter for the lesser and 1,350 millimeters for the larger, and the stroke is 1,200 millimeters. Each fly-wheel has a weight of 31,000 kilogrammes and a diameter of 5.7 meters, cast in two sections, and bolted.

The dynamos develop 1,500 amperes at 500 volts—750,000 watts—but are capable of increasing the capacity one fifth. The switchboard comprises three divisions, connected by bus-bars, which, when the plant is complete, will have a cross section of 10,000 square millimeters.

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The Canadian Electrical association will hold its convention at Montreal next week, and the preparations for the gathering indicate that the meeting will be in keeping with the history of the organization. The list of papers to be read is presented elsewhere. Many interesting topics are included, and the meeting should be interesting to practical men particularly.

Attention has already been directed to the agitation for improved facilities in conducting patent-office business. No industry is more interested in the expedition consideration of applications for patents than the electrical interests, and the announcement that the president has approved the act of Congress mentioned last week appropriating money to largely increase the working force of the Patent Office will be hailed with delight by inventors and manufacturers alike. The necessity for legislation to relieve the congested condition of affairs which now exists in the Patent Office has been obvious to inventors for years, but owing to shortsightedness this end has always been defeated, on the ground that it would entail the expenditure of large sums of money. Those who are familiar with the subject call attention to the fact that the Patent Office annually turns into the United States Treasury over $200,000, after paying all its runnig expenses. This of itself justifies the expenditure, it would seem, as the inventors and manufacturers of the country are certainly entitled to prompt and accurate service, and this can only be obtained by providing additional force.

It is now several years since the American Institute of Electrical Engineers has held a general meeting in the West, and for this reason alone the gathering at Omaha next week should include many who could not conveniently attend the meetings that have been held in eastern cities. There are many other reasons why the attendance of western members should be large. The exhibition at Omaha is now in an advanced stage, and those interested in the practical application of electricity will find much to occupy their minds. It is needless to say that the theoretical and historical features have not been overlooked or neglected. Both the Institute and the exposition should profit by the gathering at this time.

Among the subjects that will be discussed at the meeting of the Independent Telephone association in Chicago on June 30th will be the patent situation, the Berliner action, inter-municipal and long-distance connections and improvements in service of this nature. The advancement that has been made in this department since the last meeting will lend interest to the discussion. The president says that the meetings will be open to members only. It seems that an organization of this character, appealing to popular sympathy and support, should hold public meetings at which popular subjects could be discussed. It is hard to enlist public support for a secret movement, and it is even harder to maintain interest among the members of the organization under such conditions. The experience of the old Telephone association is sufficient to prove the futility of such efforts, and other organizations of similar character have fallen by the wayside, simply because they failed to command public support. The subject should be carefully considered by the organization before it becomes irrevocably committed to executive sessions.

The electrical industry will be interested in the proposition now under consideration by the government to investigate the trade relations of this country with China. The State Department has asked Congress for an appropriation of $20,000 for the purpose of sending a commission to China to study the commercial conditions of that country as they affect those of the United States. American manufacturers find that they can fill a larger demand than that of the home market, and they are looking to other countries, especially in machinery, electrical apparatus, hardware, bicycles and other manufactures of iron and steel. The State Department, through its consular representatives, is making strenuous efforts to advance the commercial and industrial conditions of the country, and secure the trade of South American countries. The Far East, and especially China, presents equal opportunities, which European countries are even now cultivating. China has a population of 400,000,000, and its foreign commerce amounts to about $200,000,000 annually. Great Britain obtained about two-thirds, Japan one-eleventh and the United States one-twelfth in 1896. American products are already popular in China, and statistics show an increase in our export trade to China from $8,117,059 in 1893 to $17,078,065 in 1897. This includes only merchandise transported directly to that country.

In a singularly infelicitous introduction to its report of the recent meeting of the National Electric Light association in Chicago, the Electrical World of New York gravely remarks that "The city chosen is a little outside of the center of distribution of central stations, if, in their moments, the relative size is considered." The reference to the "moments" of central stations is mysterious; but, if it is eliminated, the meaning of the sentence seems to be that Chicago is rather an out-of-the-way place to hold a convention of the really important central-station men of the country. If the Electrical World is correct in this assumption, it seems too bad that the fact was not impressed on the members of the association, as, by reading the World's account a little farther on, it is seen that it was decided "to hold the annual meeting in May or June each year, alternately in the cities of New York and Chicago, unless otherwise directed by the executive." And this despite the announcement of our inapt contemporary that "Western central stations are, as a rule, comparatively small, and their officers oftentimes unable to spare the time and money involved in the long trip from anywhere in the West to Chicago."

Western men did much for the success of the Chicago convention, and the foolish and untruthful characterizations of our contemporary will not be relished. The Electrical World assumes to represent the development of the industry in the country at large, and it will scarcely add to its popularity in the West by making silly and invidious distinctions.

The formation of a corps of electrical engineers in England seems to have been retarded because the uniform selected did not meet the approval of the fastidious volunteers. One of these dress-parade soldiers has written the London Electrical Review that "a friend on hearing that the uniform of the Electrical Engineers Volunteers was to be the same as that of the volunteer battalions of the Royal Engineers at once gave up all idea of joining the corps, although he was very keen on being a member when he first heard that such a regiment was to be enrolled. He is now making arrangements to join the Yeomanry Cavalry, as, to use his own words, he will then be able to walk through the public streets in uniform without being insulted and his friends will not be ashamed to speak to him." This singular statement is explained by the fact that "the great majority of the British public always associates the red coat with that useful but much maligned body of men, viz., the militia." It has been suggested that a compromise be effected, owing to the fact that "it is now too late to do away with the red tunic." It is proposed that the "facings be such as to be entirely different from any other regiment."

In this country, it is safe to say, the engineers who offered their services to the government never gave the matter of uniform a thought. They had more serious business on hand, and had no time for show. Besides, the men who wear Uncle Sam's uniform can always "walk through the public streets without being insulted."

American telephone exchange managers may find material for reflection in the report of the parliamentary investigation into the workings of the British telephone service. It was developed in the course of the inquiry that the National company, which has a practical monopoly of the business, had more subscribers and charged a higher rate for service than the government at Newcastle, where there was a Postoffice exchange in competition with the National system. It was also announced that the government service was not conducted at a loss, as had been assumed, but really returned a fair profit to the government. Upon the subject of granting franchises to competing companies there seemed to be no room for doubt as to the position of all concerned. The government officials were as firmly opposed to the plan as the corporation's representatives. It was admitted that there was good reason for complaint, and that there had been demands for competition in many places. Several cities had applied for rights, but to all these petitions the government had turned a deaf ear. The Postoffice officials denied that they were influenced in reaching this decision by a desire to favor the National monopoly. They believed that the telephone business, like the telegraph, should be conducted by the government, and ultimately would be assumed by the Postoffice. For that reason alone they opposed a division of the business at present. It was generally admitted, however, that there was no hope of immediate relief, as the British public had not had sufficient time to become thoroughly aroused. Possibly by 1911, when the National company's license expires, the government may be ready to take action. Until that time, however, the public must make the best of a poor service.

WAR NEWS.

Volunteer Engineers.—Provision has been made for the temporary headquarters, for enlistments, of two regiments of the brigade of volunteer engineers for the army. The First Regiment will have headquarters in New York and the Second Regiment in Chicago. This brigade of engineers has been provided for by a special act of Congress. Each regiment will consist of one colonel, one lieutenant-colonel, one adjutant (first lieutenant), one quartermaster (first lieutenant), one surgeon, two assistant surgeons, one chaplain, one sergeant-major, one quartermaster-sergeant, one chief musician, two principal musicians and three battalions. Each battalion has one major, one adjutant (first lieutenant), one quartermaster (first lieutenant), one sergeant-major, one quartermaster-sergeant, one hospital steward and four companies. Each company will consist of one captain, one first lieutenant and second lieutenant, eight sergeants, eight corporals, two musicians, 45 first-class privates and 28 second-class privates. Total: Commissioned, 33; enlisted, 1,106; aggregate, 1,159. The company pay list has been fixed by the government as follows: Captain, $2,000 a year; first lieutenant, $1,600; second lieutenant, $1,500; adjutant (first lieutenant), $1,800; quartermaster (first lieutenant), $1,800; sergeant-major, $43.20 a month; quartermaster-sergeant, $43.20; sergeant, $40.80; corporal, $24; first-class private, $20.40; second-class private, $16.80. Uniform and clothing. Each recruit is required to pass a strict examination in regard to his engineering capabilities, as well as to his physical health. His height must not be less than five feet four inches, and his weight not less than 120 pounds nor more than 190. The equipment of the men will comprise that of the infantry, while their uniforms will be similar to those worn by the engineer corps in the regular army. While in camp the troops will be armed and drilled as infantry, as they are classed as line troops, and if called upon must take their place in the line of battle. The officers have been selected for their skill as military, civil, electrical, mechanical and topographical engineers, while the men who will be accepted must be proficient electricians, telegraphers, steam engineers, surveyors, dock-builders, divers, sanitary engineers and mechanics of various trades, who will be useful in the construction and destruction of fortifications, field work, intrenchments, bridges, roads, railroads and field engineering work generally.

The officers of the First Regiment include several prominent electrical men. Eugene Griffin of the General Electric company is the colonel. Colonel Griffin is a West Pointer, and had a record of 14 years as an army officer before going with the Thomson-Houston company. Dr. Louis Duncan of Johns Hopkins University is one of the majors. He is also a former army officer, while his standing as an electrical engineer is of the highest. William B. Parsons, chief engineer of the Rapid Transit Commission of New York, is a captain. Among those who have offered as privates is William Edison, the second son of Thomas A. Edison, and many other electrical men.

In Chicago the examination of candidates for the positions of officers in the Second Regiment was held during the week at Indiana avenue and Sixteenth street by Colonel Willard Young, the commander. Recruiting offices will be established at Springfield, O., Cincinnati, Indianapolis, Chicago, St. Paul, Omaha, Denver, Salt Lake City, San Francisco and Portland, Ore., to which recruiting officers and agents will be assigned by the regimental commander. The camp of the First and Second Battalions is established at Fort Sheridan; for the Third Battalion, at the Presidio, Cal. The First and Second Battalions will be made up as follows: First Battalion, two companies from Springfield, O., two from Cincinnati and one from Indianapolis; Second Battalion, two companies from Chicago, one from St. Paul and one from Omaha. G. A. Hurd of the Crane company is a candidate for a captain's commission.

The Signal Service.—Captain Edward Bernard Ives, recently appointed and confirmed a captain of volunteers, has undertaken to secure recruits for the Signal Corps in New York and Brooklyn. Fifty men are wanted. Reference will be given to applicants from the Signal Service of the National Guard. Under the law, two-thirds of the entire number of recruits required must be skilled electricians and telegraphers.

A signal corps from the Volunteer Signal Service Corps, which is being recruited and established at Tampa, under the command of Major Samuel Reber, has established telegraphic connection between General Coppinger's field headquarters and the Western Union headquarters.

A Chattanooga dispatch states that Major Glassford of Camp Thomas is swamped with the applications of those who desire to enter the Signal Corps. He has received 500 in the last week. Almost all of those applying are men of high professional rank.

Major R. E. Thompson, chief signal officer of the expeditionary forces to Manila, will sail with General Merritt, and is now preparing to go at an hour's notice. The Signal Corps is yet lacking in its required quota of expert telegraph operators, who will perform an important part in the conquest and government of the Philippines. Fifteen are coming from St. Paul, to be followed by others from eastern cities. Major Thompson will leave an officer in San Francisco to enlist men for the corps and forward them, together with necessary supplies, to Manila.

At Tampa a company of engineers has been formed from the men of the First Illinois Regiment. The captain is Taylor E. Brown, a member of the firm of Poole & Brown, patent lawyers in Chicago. He is supported by Lieutenants Laramie and Curran. The company will be a part of a battalion of selected engineer troops.

Arthur C. Parsons Appointed Lieutenant in Navy.—Among the late appointments announced by the Navy Department was that of Arthur C. Parsons, who was made lieutenant in the navy on June 17th. Lieutenant Parsons' commission reached Chicago on Monday morning and he immediately qualified. He expects to enter active service at once.

Lieutenant Parsons is 40 years of age and is well qualified by training and experience for his new duties. He was born at Keokuk, Iowa, on June 25, 1858. At the age of 18 he entered the United States Naval Academy at Annapolis, being named by the Hon. George W. McCreary, then member of Congress and later secretary of war. After being graduated in 1881 Mr. Parsons was assigned to duty on the old Brooklyn and saw two years' service on that boat, cruising in South American waters. At the expiration of that period he was honorably discharged under the act of Congress of August 5, 1882, limiting the number of graduates of the Naval Academy to be retained in such service.

It was not until June, 1890, that Mr. Parsons entered the electrical field. He has been identified

LIEUT. ARTHUR C. PARSONS.

with the Edison interests since that time. He gained his first experience with the Edison General Electric company, being assigned to the railway-construction department. While following this branch of the business he did considerable pioneer work throughout the West and visited Milwaukee, Fort Scott, Kansas, La Salle, Ill., Chicago, Eau Claire, Wis., and Boise City, and in the latter city started the first electric street railway in Idaho. He operated the line for some time. He had charge of several installations and was engaged in various capacities in many of the electric railway enterprises that were then being established. In November, 1891, he returned to Chicago and was assigned to the stationary motor department. For a short time he traveled for the Chicago office of the Edison General Electric company, but later was occupied with the city trade, and has ever since made Chicago his home. In July, 1892, he entered the service of the Chicago Edison company and has been connected with the contracting department of that company for the last six years. In all that time he has been engaged in the South Side territory and is well acquainted with that district.

Lieutenant Parsons was one of the most popular members of the Chicago Edison company's staff, and when it was learned last week that he had been appointed lieutenant in the navy, his associates determined to celebrate the event by a dinner at the Grand Pacific Hotel. The affair proved an enjoyable event. Louis A. Ferguson presided as toastmaster and several excellent speeches were made.

Before going to Washington Lieutenant Parsons made a short visit to Keokuk, where his parents still reside.

Telegraph and Telephone War Taxes.—The Washington correspondent of the Western Electrician directs attention to the special provision of the war-revenue measure, which was passed last week, providing that after July 1st no telegraph company or its agent or employe shall transmit to any one either a dispatch or message without an adhesive stamp denoting the tax imposed by the act being affixed to a copy thereof, or having the same stamped upon it. A default of this provision will incur a penalty of $10. But it is provided that only one stamp shall be required on each message or dispatch, even though it be sent to more than one company. The only exceptions made are in the cases of messages or dispatches of the officers or employes of any telegraph or telephone company on affairs concerning the company, messages or dispatches of like persons on railroads and government official business. The law governing the operation of telephone lines is as follows: "It shall be the duty of every person, firm or corporation owning or operating a telephone line or lines to make within the first 15 days of each month a sworn statement to the collector of internal revenue in each of their respective districts, stating the number of messages or conversations transmitted over their respective lines during the preceding month, for which a charge of 15 cents or more was imposed, and for each of such messages or conversations the said person, firm or corporation shall pay a tax of one cent. Provided, that only one payment of said tax shall be required, notwithstanding the lines of one or more persons, firms or corporations shall be used for the transmission of each of said messages or conversations. Tax on telegraphic dispatches is also one cent for each message.

Cable Communication.—Whether all the cables connecting Cuba with the rest of the world have been cut is a question that still remains unanswered. As late as June 19th it was reported that the remaining Santiago-Kingston cable had been cut the night before by Captain Goodrich of the auxiliary cruiser St. Louis. It was stated that the cable was cut off Santiago, within a mile of the shore batteries. Still, there have been so many cable-cutting cable-cutting stories—so many submarine wires have been cut, apparently, without effective result—that only an official announcement can be accepted as conclusive.

A Madrid dispatch in the American papers states that on June 15th, in the Chamber of Deputies, General Correa, minister of war announced that telegraphic connection with Santiago and Guantanamo had been broken. The government, it was said, was consequently without news as to whether the Americans had landed at either of those places.

Another phase of the situation is brought up by the statements that the American commanders at Manila and Santiago will endeavor to secure the ends of severed cables, and, with the proper men and instruments, open direct communication with Washington. The point has been made that the cable companies, operating under fran chises granted by neutral governments, may feel obliged or may be instructed by their respective governments to refuse to forward over those parts of their lines which are in neutral territory messages sent by Admiral Dewey or Admiral Sampson for transmission to Washington. It is said that dispatches from Dewey have thus been "held up" by the British operators at Hongkong. On the other hand, it is reported from Washington that the French cable company owning the line from Santiago has agreed to allow the transmission of all messages from Sampson as soon as the cable shall have been repaired and fitted with the necessary instruments for the operators. Concerning the question of the rights and duties of the cable companies, Theodore J. Harper of New York, said to be a well-known international lawyer, says: "The law of nations does not compel those at peace to abandon their usual occupations. I see no reason why a cable owned by citizens of a neutral nation, on neutral territory, may not continue impartially to send all messages received from any source whatsoever, without involving in any way the violation of the laws of neutrality." In other words, there would seem to be no reason why companies may not refusing to forward Sampson's dispatches, providing all messages filed in the neutral territory, at Mole St. Nicholas, were also allowed to be transmitted.

It is stated that the direct cable communication with Cuba, under military direction, is important to the Washington authorities, has now been secured. General Greely is said to have received from Lieutenant-Colonel Allen on June 21st a dispatch stating that the first American military station in Cuba, Camp McCalla, Guantanamo Bay, had been brought into electrical communication with the rest of the world by the establishment of a telegraph office, which was opened at five o'clock. The French cable company, whose line runs from Santiago to Guantanamo Bay, and thence to Cape Haitien, where a direct connection is obtained with New York, was directed to restore communication with Guantanamo, with permission to send commercial and domestic dispatches, under a strict military censor-ship necessitated by war conditions.

Searchlights.—The Yale, the Harvard and the Minneapolis, refitted at Newport News, will be furnished with extra searchlights of the highest power. It is said that these three ships will have more searchlights than any other vessels in the navy when they are thoroughly overhauled.

Ten large electric cars, manufactured in St. Louis, have just been shipped from Newport News, Va., aboard the German steamer Pisa, for Hamburg. These are said to be the first American manufactured electric cars to be shipped to Germany, and are to be tried as an experiment in competition with German manufactured cars.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

James Gibbs, an electrician in the employment of the Marshall Telephone company, Marshalltown, Ia., died recently of a hemorrhage.

The E. H. Martin Telephone company of Webster City, Ia., has added a calculagraph for computing time on toll messages.

H. W. Doolittle is the new manager of the Mutual Telephone company of Des Moines.

Manson, Ia., will vote July 1st on granting a franchise for a telephone exchange to the Central Telephone company.

Work has been begun on the Home telephone exchange at Centerville, Ia., It is to be in operation by August 1st.

J. W. Christie, manager of the Minneapolis office of the Northwestern Telephone Exchange company, has been promoted to assistant superintendent, with jurisdiction over the lines in Minnesota and the Dakotas. He is succeeded by H. G. Webster, formerly manager of the Grand Forks office.

Bain Brothers have bought the telephone line between Trenton, Ia., and Gilman City, and will put it in the best possible shape.

The new telephone exchange at Litchfield, Minn., is completed.

The Merrill, Wis., Telephone company has 215 instruments in use, and orders for 15 more have been filed. Another section has been added to the switchboard lately.

Work has been begun on the telephone exchange at Albia, Ia.

North Branch, Ia., wants the Mutual Telephone company to extend its wires to that place, and it will probably be done.

There is talk of a telephone line being built from Biddick City, Ia., to Strand.

The Jefferson Telephone company contemplates extending its toll lines to Rusk, Pocahontas, Rolfe, Havelock, Plover and Mallard, Ia.

Lamberton, Minn., has granted a franchise to the Northwestern Telephone Exchange company.

Two cables of the Iowa Telephone company, crossing the river between Davenport, Ia., and Rock Island, Ill., were accidentally burned by the explosion of a gasoline forge, and the service between the cities was crippled until repairs could be made.

The Minnesota Mutual Telephone company proposes to extend wires to connect with Grantsburg, Wis.

The Central Telephone company proposes to extend its wires to Baxter, Ia.

The Northwestern Telephone Exchange company has inaugurated some extensive changes and improvements in its exchange in Sioux Falls, S. D. The switchboard has been enlarged, new and taller poles have been set and a mile of aerial cable set.

The Northwestern Telephone Exchange company is expected to extend its wires to Kerkhoven, Minn.

Electric-light Wires as Telephonic Circuits.

F. J. Jervis-Smith of Oxford, in Nature, describes a method of using electric-lighting wires as telephonic circuits. He was requested some time ago to try to localize a fault in an electric-light main, by means of a certain form of inductor used in conjunction with a telephone but not connected to the main. While using it, it occurred to him that probably the main might be used instead of a telephone wire. His first experiments were not productive of good results, as a small fraction of the company's current passed continuously through the telephone. In October, 1897, he placed one-third-microfarid condensers in his telephone circuit at each end; these stopped the current, but in no way reduced the telephonic effects. If the note given out by virtue of the rotation of the armature of the dynamo is great, it can be very greatly reduced by placing an inductively wound resistance in the circuit. The resistance, he writes, does not appear to modify the telephonic effects in any marked degree. This probably arises from the fact that the electromotive force due to the secondary coil of the telephone transmitter is high. The experiment was successfully made over two miles of a main, which was carrying the full load used in lighting the town.

Extensions and Improvements.

F. G. Blaisdell's franchise for the erection and maintenance of a telephone line at Yuma, Arizona, was extended 90 days on May 26th, as he desires to make some improvements.

Increased facilities for telephonic communication have been afforded by the National Telephone company and the Postoffice at Hereford, and the town is now connected with the trunk service.

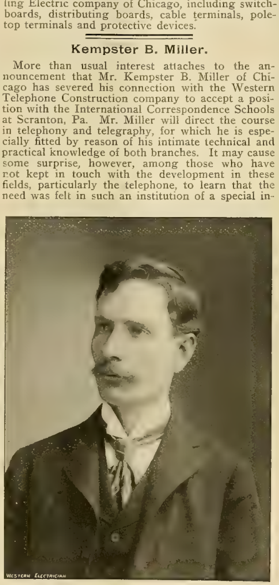
The E. H. Martin Telephone company of Webster City, Ia., is rebuilding [illegible] plant. The multitude of overhead wires [illegible] in [illegible] wire cables, the cable terminals, the protective devices and the switchboard being of the Bell type manufactured by the Sterling Electric company of Chicago.

Experiments have been made with the telephone between Manchester and Brussels, the operators at the two cities being put in direct communication with each other. Both land and sea wires had to be utilized, the wires running from Brussels through Courtrai and Lille to Calais, where they were connected with the London-Paris telephone cable under the Straits of Dover.

The Valley Telephone company, operating in Saginaw, West Saginaw, Bay City, West Bay City and Flint, will probably have all of its exchanges in operation before July 1st. It is said that the engineering work upon these exchanges is of the highest class, the conduit work, the cable work, the pole-line work, the inside wiring, and the arrangement of the exchanges themselves being models of workmanship and of perfect arrangement. This company is equipped with the full line of the Sterling Electric company of Chicago, including switchboards, distributing boards, cable terminals, pole-top terminals and protective devices.

Kempster B. Miller.

More than usual interest attaches to the announcement that Mr. Kempster B. Miller of Chicago has severed his connection with the Western Telephone Construction company to accept a position with the International Correspondence Schools at Scranton, Pa. Mr. Miller will direct the course in telephony and telegraphy, for which he is especially fitted by reason of his intimate technical and practical knowledge of both branches. It may cause some surprise, however, among those who have not kept in touch with the development in these fields, particularly the telephone, to learn that the need was felt in such an institution of a special in-



KEMPSTER B. MILLER.

structor on these subjects. In making a selection for this position the management of the school certainly found an experienced and capable expert of high standing in the profession.

Mr. Miller was born in Boston on August 14, 1870, and entered Cornell University at the age of 19 years, taking the course in electrical engineering. He continued in this institution until 1893, when he was graduated. In the meantime, however, he gained considerable practical experience in the Thomson-Houston works at Lynn, where he spent his vacations in the draughting-room. On completing his course at Cornell he took the civil-service examination, and within a month received an appointment as fourth assistant examiner in the United States Patent Office at Washington. During the three years he remained at the Patent Office he was occupied in examining claims in the class of telephony, which gave him an excellent view of the telephone field, and he became particularly familiar with the patent situation. He left the Patent Office in January, 1896, to accept a position with the Westinghouse Electric and Manufacturing company at Pittsburg, and to patent several inventions made during his term in the Patent Office. He did not stay with the Westinghouse company long, however, but accepted a position with the Western Telephone Construction company as chief electrician. During the last two years he has held that position, and has also been engaged as expert in a large number of patent cases for that company.

Mr. Miller has written considerably upon telephony as viewed by the independent manager, and he has been an earnest advocate of good construction and high class service. He has also taken an active interest in the subject of securing the adoption of standard diagrams of electrical apparatus by the Patent Office. Mr. Miller was a valued member of the Chicago Electrical association and was an influential factor in the work accomplished by that organization.

English Telephone Investigation.

The parliamentary investigation committee which has been enquiring into the condition of the telephone service in England has devoted considerable attention to the terms of the public grants under which the service was being given. It seemed to be the general impression that the National company had given preference to its own subscribers in the use of trunk lines in spite of the understanding with the government and the contract with the Postoffice Department. Among the witnesses examined was F. T. Lamb, second secretary of the Postoffice, who said that his special department was the telegraph and telephone service. He was in charge of the telegraph department since April, 1889, and for many years before he had had a great deal to do with it. He had been concerned in the administration of the telegraphs since 1870. He gave evidence before the committee of 1892, and also before that of 1895. The principal recommendation of the committee of 1892 was that the license of the telephone company should not be extended beyond 1911. It left the government the responsibility of entering into arrangements with the telephone companies, and made the recommendation that the license should not extend beyond 1911. He had a hand in drawing up the treasury minute, in the sense that he prepared the information for the Postoffice, which was embodied in that minute nearly word for word. That information was prepared in view, at any rate, of limited competition. All along the Postoffice and the Treasury had in view competition, and freedom of competition was reserved carefully from the earliest date, and it was again reserved in that minute. In 1892 agreements were drawn up, but were not signed. The heads of the agreement were embodied in the agreement of March 25, 1896. The final agreement was with one company. In response to the question, "Did the Postoffice encourage the amalgamation of these two companies?" the witness said: "It was not a question of the Postoffice. It was a question of the government, which gave direct instructions to the postmaster-general. The postmaster-general was in constant communication with the chancellor of the exchequer, and, acting for the government, he facilitated the amalgamation of these companies. Practically, the amalgamation had taken place when the heads of the agreement were signed." Continuing, the witness explained that in 1889 Mr. Raikes was postmaster-general, and offered strong opposition to the amalgamation. Not only was there no opposition to the amalgamation in 1892, but it was rather encouraged by the postmaster-general acting on behalf of the government. The agreement undoubtedly facilitated the amalgamation of the National Telephone company with the New Telephone company, and was signed with the full knowledge of the chancellor of the exchequer and other members of the government. The formal signatures were attached on August 11, 1892, in Sir James Fergusson's room in the House of Commons. The witness had been in constant attendance at the House of Commons with the postmaster-general, and was present at discussions, and he knew that the postmaster-general acquainted the chancellor of the exchequer of what was going on.

Concerning the development of the industry, the witness said that the trunk system had gone on extending since 1896. Thirty extensions had been carried out or were being carried out under guarantee by the company. The miles of wires purchased for the company were 29,000. The miles of wires constructed were 24,526. The mileage in course of construction at the present time was 4,647 miles. The mileage guaranteed was comparatively small. With regard to the areas of the company, the principles adopted in making them were as follows: Industrial areas of wide extent should be recognized in cases where there are any considerable towns forming centers of business; neighboring towns intimately connected with one another in business relations should be included in the same area, and small towns and villages, in any one of which it would be hopeless to establish a local exchange system unless there was some cheap means of communication with each other, should be grouped together in one area. All urban districts were areas in themselves. Pretty well the whole of the country was divided into areas in which the National Telephone company had the power to establish an exchange without further license. The company was under no obligation to start an exchange, but the Postoffice could grant a license to any other body to start an exchange. Since the agreement was signed in 1896 in only one case had the monopoly of the telephone company been broken down, in Guernsey. The charges there were low, but he did not know that they were lower than the company was prepared to supply the service at. Changes had been made in the areas from time to time, the tendency having been to rather increase the area. The largest area was London. The area was not nearly so big as in some places abroad. There was no limit on the discretion of the Postoffice as to laying trunk wires. The only effect a large area had was to reduce the use of short trunk wires. In a number of those areas they had Postoffice exchanges competing with the National Telephone company's exchanges. The principal exchange was at Newcastle-on-Tyne, where they had 626 subscribers. The

number of subscribers to the National Telephone system in Newcastle-on-Tyne was much larger. The charges of the Postoffice were: For business houses, £8 within half a mile of the exchange, £9 within three-quarters of a mile, and £10 within a mile. He believed the charge of the company was a uniform one of £10. Previous, however, to October of last year the Postoffice charged £10 for half a mile, £12 for three-quarters of a mile, and £14 for a mile. The Postoffice charges were based on what was supposed to bring in a profit to the taxpayer. The management was not allowed to canvass, and not allowed to give preference to firms. The company gave preferences, but he could not say to what extent the preferences had been given by the company. The reduction in the price at Newcastle was bringing an increase in the number of subscribers. The Postoffice had offered to put its subscribers at Newcastle in communication with the subscribers of the company, but the company was not willing that that should be done. The Postoffice had no legal power to insist upon such a connection.

The chairman asked: "Do you know any towns where there is competition in which the price charged is lower than where there is no competition?" To which the witness replied: "I do not think that is so."

"You do not think competition has had any effect upon their prices?"

"I cannot tell what effect it has, but, as a matter of fact, the company's charges are higher in Newcastle than in other towns, probably because they are smaller towns."

"Is it not a fact that the company's prices are based on your charges?"

"I think that is so."

"You have been in unequal competition owing to higher rates?"

"Yes."

"Without disclosing secrets could you tell the committee whether you have made any loss?"

"No."

"And we may say you have made a fair profit."

"Yes."

"Although there are two competing systems?"

"Yes."

"Are the charges of the company higher in Cardiff and Swansea?"

"For certain distances I think they are."

"Is it in the interest of the public that the National Telephone company should not have the competition of the Postoffice?"

"I find it very difficult to answer that question. My opinion is that it is very undesirable for a private company to have a monopoly. On the other hand, I am firmly convinced that the establishment in one town of competing systems of telephones would not be in the interests of the public. My opinion is that the whole thing should be in the hands of the Postoffice."

It was announced that there was no effective competition between the New company and the National, for the New company had no exchange. The competition in Manchester was a very feeeble competition. The tendency of the policy of the Postoffice since 1892 had been toward making the National Telephone company a monopoly, but at the same time all the rights of the postmaster-general had been fully preserved. The heads of the 1892 agreement were brought before the House of Commons in 1894, when it was laid on the table. The Treasury minute lay in the House in May, 1892, and the bill to raise the money for the purchase came before the House on May 26, 1892. The agreement was signed August 11, 1892, and the postmaster-general went out of office on August 19th. The agreement was signed the day the vote of censure on the government came in.

Some of the Postoffice subscribers in Newcastle had been obliged to become subscribers also to the National Telephone company.

General application had been made by local authorities and other companies for licenses to start telephonic services in different towns, and they were ready to comply with the terms of the Treasury minute. The postmaster-general had been in consultation with the chancellor of the exchequer on the subject, and they had not seen their way to granting those licenses. They had received applications from the corporations of Glasgow and Tunbridge Wells and Manchester, and in Glasgow it was admitted that the service was defective, yet in no case has a license been granted.

The government would not allow municipal bodies to establish telephonic systems in places where there was no service, but would leave it to the Postoffice. The Postoffice had not established many services of late years, because there was no demand for them. From a commercial point of view, it was not an unreasonable system for the company to adopt. His remedy would be to take over the whole system, and put it in the hands of the Postoffice.

When the legal proceedings against the telephone company were going on the Postoffice submitted proposals to the Treasury for establishing telephones, and in a letter dated December 16, 1880, the Treasury consented, on the understanding that it would enable the department to negotiate satisfactorily with the telephone companies. He believed that great inconvenience to the public would arise if they had competitive systems in different places. It would probably take eight or nine years for the Postoffice to establish a really proper competitive system over the country. In Sweden the state had bought up all the local districts, with the exception of one. In France there was no private company, and in Italy there never had been a private system. The only place where there was a municipal service was Holland, and in that country the trunk lines were in the hands of the government. Some facilities had been given by the government to the telephone company outside the agreement.

Analysis of the Cost of the Generation and Distribution of a Unit of Electricity.

[*Continued from page 377.*]

coal as 575 and 571. It is specifically stated that it is gross watt-hours and the station is described as a station where the loss would be quite high. Mr. Rice has no doubt given the statement careful consideration.

Mr. Ferguson: The Budapest station pays more for coal than we do. They pay $4 or $5 a ton, so that the figure 571 is possible. It costs them more for coal at Budapest than it does at our best American stations.

Mr. Dow: With all due respect to the Budapest station, I do not think the figures are correct. The main engine alone might accomplish that result; but to get the whole output down to such a figure seems to be out of the question. There is a mistake of about 200 watts.

Mr. Creden: The Chicago Edison company generates a kilowatt on about 4½ pounds of coal, equivalent to about 28 pounds, which gives an evaporation of about six pounds on an average day's run. Coal used in Budapest would safely give about 10 pounds on an average, which readily accounts for the large number of watts generated. The Chicago Edison company generates about 250 watts per pound of coal. The coal will give an evaporation of six pounds, perhaps a trifle less, on a run of 24 hours. The coal at Budapest is of a better quality and will give an evaporation of 10 pounds, which will account for the high figure specified. I think the figures presented by Mr. Rice are about right. They are possibly a trifle high, but not as high as Mr. Dow represents.

President Insull: I have here a chart which shows the average cost of various operations in connection with our operating expenses, except the interest portion of the operating expenses. I present this to you now as it is a matter bearing not only on my own remarks, made a short time since on the question of cost and selling price, but also upon the paper just read. These figures are taken from our actual balance sheet of the year. The largest amount of expenses is general expenses. The reason for that is that one-third of the expense is in getting new business, one-third administrative expenses and the balance insurance, taxes and similar items. Other items, which are simply average items for the year, could be treated in the same way. For instance, take the question of street repairing, that item will go down continuously until you get your system in such shape that that item will not bear any particular relation to the amount of your output unless the output exceeds the capacity of your conductors. The biggest item of expense apart from the general expenses is, as Mr. Rice indicated, lamp renewals, when he referred to the question of regulation being more important than the question of economy. The important point that the chart brings out is the interest cost. You might have all of your operating expenses presented to you outside of interest and then you might lose money, if your selling price is not on the right basis. Take a case of a 3.7 load-factor, an office building, and not an extreme case, the interest charge is 80 per cent. of the total operating charges. Here is a case of an ordinary fancy store—these cases are taken from the actual bills—and you see there that the interest charge is a little less. The importance of the interest charge in this case will be brought home to you when I tell you that the difference between six and five per cent. in the price you pay for your money and whether you sell your bonds at 90 per cent. or sell them at par, makes a difference of 16 to 20 per cent. in the cost of operating expenses. That statement alone will show you that the public is more interested than we are in the question of protecting us in the enjoyment of our right to do business. Now we come to an all-night restaurant where the load-factor is 48 per cent. and the interest charge is only 26 per cent. of the total expenses. These are the two extreme cases I mentioned to you in my opening remarks. In one case you could sell current to a man at about a quarter of what you could sell it to another man and make more money out of the first man than out of the second man. You will find that the same relation goes all the way through with the different classes of business. Power business is not quite as good as all-night lighting business. The load-factor is about 35 per cent. and the interest expense about 32 per cent. With a dry-goods store the interest is about 40 per cent., a small lunch counter 45 per cent., and a saloon 52 per cent.

It is generally supposed that the best business is the power business. I remember in the early days when the rates were established to foster the power business of the Edison Electric Illuminating company of New York, the claim was made that you could afford to sell power at one-half the price, if your current was going to be used for power when it was not going to be used for light. We have found that the power curve and the light curve cross each other for 60 days during the winter, and the claim which was made for the power business proved a fallacy. Large stations can get a class of business which will yield a bigger return on investment from lighting customers than from power customers at a low rate, because the interest cost, if you have a 50 per cent. load-factor is only 25 per cent. of the total cost; whereas with power customers the interest is about 35 per cent. This chart, properly studied, should enable a man running the Chicago Edison company to make a price-list that would fit all kinds of customers. If we can do that in our business, surely you can do it in your business. You will find, too, that the adoption of a system of rates that will take care of these different conditions will affect these items very materially. It will not affect lamp renewals, of course. It will certainly affect station repairs, general supervision, station labor, fuel and also general expenses. In other words, it will affect by far the greater proportion of your expenses outside of interest charges, beside very materially affecting your interest charges, by putting your revenue on a basis so that it is in proportion to the interest you have to pay to take care of a customer whom you are supplying with current. You are putting your business on a basis so that you get a return on the investment which you have to provide for each separate customer. This subject came up for discussion last year at Niagara Falls. One gentleman, whom I am sorry is not here to-day, took the ground that we had to sell the product at the same price to everybody. If you do you are selling your product at different prices to everybody, because in one case you can make money, and in another case you lose money. Take, for instance, the case of an office-building customer. His business won't enable you to pay interest and depreciation on the investment. You may have to take him as a good business policy, but do not imagine when you put on 5,000 lights in an office building, that you are going to make any money on them. If the expenses of a station are followed out in this way you can get a great deal more out of the method by which you sell than you can out of the method by which you produce.

Mr. Armstrong: What would you call your standard rate? What would be your base rate?

Mr. DeCamp: Do you establish a base rate for the least desirable customer and work down, or make a base rate on the most desirable customer and work up?

Mr. Insull: It is simply a question whether you are going to figure on lamps connected, which is fallacious, or adopt some scheme which enables you to register the maximum load.

Mr. Hubeley: How can you regulate that plan on a meter basis; different rates for different services?

Mr. Insull: There are various ways of arriving at that.

Mr. Hubeley: I do not see how it could be done on a flat rate, on a contract basis. I do not see how you could do that without a great deal of computation.

Mr. Insull: Do you mean a meter flat rate or contract basis?

Mr. Hubeley: Contract basis; so much a month.

Mr. Insull: We would go into the hands of a receiver on that basis.

Mr. Hubeley: Do you use meters here under that plan?

Mr. Insull: Yes, sir.

Mr. Barker: You spoke of the different classes of business earning a certain percentage on the investment. How do you apportion the investment among the different classes of business?

Mr. Insull: On our maximum output per year. We take an investment of that kind, and divide the one by the other, and get the investment per unit at the maximum output. Then we get the maximum demand for current from the customer, and in that way we can figure his load factor. We know what it costs for our investment per maximum unit of output, and we know our customers' maximum demand.

Mr. Hubeley: How do you know that?

Mr. Insull: There are a number of ways of arriving at it. We use a Bristol recording wattmeter and the Wright demand meter.

Mr. Wendell: In towns of 25,000 people there are a number of small consumers whose maximum demand may not be five lights. They are very desirable customers. What would you do in their case?

Mr. Insull: If your smallest customer is a man who burns one light, and burns it five hours a day, he is likely to buy it at a rate of a little over one-half a cent per lamp-hour.

Mr. Wendell: How small a customer can you afford to take?

Mr. Insull: It depends upon the efficiency of the lamp. If you will give us a 25-watt lamp, we will take a customer whose demand is 25 watts.

Mr. Wendell: Can you afford to do that with the Wright demand meter? On what number of lamps do you use the meter?

Mr. Ferguson: We take every and any customer on that basis, and we have a uniform schedule of prices for everybody, based on one cent per lamp per hour; that is the base rate. We charge the full rate of one cent per lamp per hour for one hour per day as the maximum demand, and for all watt hours beyond that hour we charge a half-rate, 40 per cent. or 60 per cent., or anything that you please. In regard to the question of what customers you can afford to take, that would involve a great deal of calculation. The simplest way is to charge a minimum bill to each customer, which will cover

the smallest customer. If you charge a minimum bill for services furnished, that will cover interest and depreciation charges on the cost of the investment used.

Mr. Scovil: I would like to know whether the chart which you have shown and the percentages you gave do not include a great many motors that are used for electric power, such as elevators?

Mr. Creden: Yes; it does.

Mr. Scovil: I simply want to have it understood that Mr. Insull's deduction from his chart as to the desirability of power as a load-factor on the station is not altogether to be accepted from the showing made by the chart, for the reason that that chart includes in it many motors used on electric elevators in which the power factor is very small. Motors used for manufacturing purposes only have a much higher power-factor, and are entitled to a much better rate.

Mr. Insull: I do not say power is not desirable business, and I do not wish you to think that we do not take it.

Mr. Coggshall: You charge one rate for one hour a day, and another rate for the rest of the day. How do you do it?

Mr. Insull: That is called the two-rate system. It is done by a meter with two dials or a double meter.

Mr. Wagner: I understand from your remarks that the Chicago Edison company is going to use the Wright demand system of charging, which is a very thorough way of providing for all these different classes of services. I should like to know if there is anyone else here who accomplishes nearly the same thing by any other method?

Mr. Dow: We have more than 25,000 people, but we have not money enough to buy Wright demand meters for all our customers just yet. We are going to do so some day. However, we use demand meters on a number of customers. We use them when there is doubt of arriving at the demand by any other means. We do not believe it necessary to leave them on continuously, but we put them on long enough to make certain that we have a fair average demand for the current 12 months, and in such cases we make the demand established by meter, and base a contract on it with the customer for the current 12 months. We say to them that they shall pay for that amount for 12 months, at the maximum rate, and everything beyond that at a minimum rate, and at the end of 12 months we will again meter in the same way, and reserve the right to put the meter on at any time to satisfy ourselves as to what the actual demand is. In some places we leave the meters on continuously.

Now to answer the question raised as to how anyone has reached the same result by other means. In the matter of arc lighting practically nine-tenths of the business is with customers whose lamps are all turned on at once. If a man has 10 arc lights he is likely to use all at the same time, so that in the majority of cases the arc lamps will be an exact measure of the demand. With certain classes of motors the same thing applies, not with all classes, by any means, because there is nothing that is more frequent than a motor running at a much less load than it is rated. They seldom use continuously any length of time the maximum. The matter of elevator motors, to which Mr. Scovil referred, is in that line. There is a large amount of motor business where you can put on an ammeter and ascertain the largest demand. As we are situated now we have been trying to develop the motor business, and inspect motors frequently, and we have not so many that a faithful man cannot visit them all in five weeks. We are not missing anything, but our method of checking depends on personal knowledge, and can only be looked upon as a makeshift. It does not compare with the method of gauging the arc lights, but as a temporary device it fills the bill. Beyond that you have still another class of customers, small barber shops, saloons, cigar stores, news stands and fruit stands, that use only a few lights and keep open long hours. They are good customers. Beyond that is the general use of incandescent lights, where some meter must be used. It limits the necessity of the application of the demand meters to one part of the business, and that may be one half or one-third of the whole business. If there is any place in the world where a demand meter is a good thing, it is in a residence. In the absence of the meter system in residences we have instituted a method of assessment according to the number of rooms in a house and the number of persons likely to use the light.

Mr. Wagner: How do you arrive at the assessment you speak of?

Mr. Dow: We inspect each house and make a list of the rooms and the number of lights in each room; and we make a charge accordingly.

Mr. Wagner: You have to collect all the data for each customer?

Mr. Dow: With the residence customers only.

Mr. Wagner: We have 75,000 incandescent lamps in St. Louis.

Mr. Dow: We have 24,000.

Mr. Robinson: In [illegible] scheme for the adoption of the Wright demand system I found a certain class of business that I did not know how to handle. It comes from lodges, churches, etc.

Mr. Dow: Mr. Wright maintains strongly that the relation of the demand, maximum customers' demand, and the time at which the demand takes place, is of no consequence; but I feel that it is, so I reclassified all these certain lines of business, which includes these troublesome customers mentioned, who think they ought to have special rates. I have churches, lodges, schools, banks and fire-engine houses on a special basis, in the last-named case because we use some of the fire-alarm telegraph poles. Our annual peak is due to the 60 days' crossing of motor and lighting loads. The banks are off before the great bulk of business comes on. I established for them, on the same set of calculations, a rate which is equitable, and known as the church, bank or lodge rate. It is got at in the same way.

Mr. Wagner: I would like to hear more about the details of the system of the Chicago Edison company.

Mr. Ferguson: Mr. Dow made the statement that he could not afford to buy demand meters, that he would do it after a while, but cannot afford to do it now. After listening to what he said, I think he is much mistaken. I think he is spending too much of his valuable time in attempting to understand the personal characteristics of his customers. I am sure that if he does that properly, if he ascertains the characteristics of his customers so well that he can approach the work done by the Wright demand meter, he must employ a large force of assistants, and when we consider that the cost of demand meters is small in proportion to the total investment, and that an immense amount of business can be obtained by using the demand meters, I think he can well afford to buy them. We will suppose that in Chicago we have 5,000 customers, and the cost of the instruments would be something like $50,000 for all these customers. We do not spend all the entire sum in one year; it would take some time. Our business has improved largely by the use of the meter, and we cannot get instruments fast enough. It seems to me that any central-station man can well afford to borrow the money, even at a very high rate of interest, and purchase the meters. The additional business that you will get by the use of such instruments will more than compensate in a few years for the total investment. We have listened to papers in these conventions showing the economy to be effected in generation and distribution and that sort of thing. It seems to me that there is more money to be made in the intelligent selling of your product than in attempting to introduce further economies in operation. With an instrument like the Wright demand meter you are put in a position where the instrument does for you what you will otherwise have to do by skilled labor at a very high cost. I say this from experience. For three years I have personally negotiated contracts for the Chicago Edison company on a basis similar to that described by Mr. Dow. I have had customers come into the office and have talked with them to ascertain the conditions under which they burned their light and made prices, with 15, 25 and up to 65 and 75 per cent. discount, depending on the conditions under which they used the light. Since we have put in the Wright demand system the work is lessened; I am able to give my attention to other things, and let the meter do the work for me. There are other ways, of course, of getting at the information, and we have used them. We have used, for instance, the Bristol recording ammeter, which is useful for ascertaining the maximum load in any customer's premises. It is slow and can only be used in large installations, like hotels, and theaters, where you desire to make a uniform discount for the entire year, which is practically the same as selling current on the Wright demand system. It is the load-factor system; the only system based on load-factor. If you know by the Bristol recording instrument that the load-factor is 50 per cent., you can make the rate for the entire year at a uniform discount, which is the same as putting in the Wright demand instrument. But it is tedious and much more expensive than buying the instruments and making them do the work for you.

In further reference to this question of dealing individually with customers, especially in residences, upon which Mr. Dow dwelt particularly, the load-factor varies greatly, and you cannot classify residences; it is almost impossible to do so. We will have a rich man, for instance, who has 200 lights in his house, at $25 a month, and another man with 25 lights and his bill is $20 a month. They would be entitled to a 25 per cent. discount on the basis of 25 cents per kilowatt-hour for the first hour and 20 cents per kilowatt-hour for the succeeding hours. The load-factor would be over 20 per cent. Theaters use light at a high load-factor; they run for short periods, and the load factor is small. Hotels are about 50 per cent. and large dry goods houses 50 per cent., and residences vary all over the line. We have not made any increase since starting in with the Wright demand system. We have not published the fact that we are selling electric light on that basis as yet. We have, however, instructed our men to take all new business on that basis. We sell arc lamps at a flat price per week from dusk to midnight. With the exception of that and the power business it is all done on the Wright demand basis. We put our arc light and incandescent light on the same meter. The reading of the demand meter is made at the same time as the reading of the wattmeter. The wattmeter is placed on the wall and the demand meter under it. The latter is graduated in kilowatt-hours, the same as the wattmeter. [Mr. Ferguson then drew a diagram on the blackboard, illustrating the methods of charging for current, which he explained to the meeting.]

Mr. Weeks: There have been few discussions before this association, Mr. President, of greater importance to central-station interests than that to which we have just listened. In the cost of our product the relative value of the interest factor has been forcibly and clearly shown, and the necessity for revision of rates or discounts has been ably demonstrated. In my judgment, the method employed by Mr. Insull, or a slight modification of it, will soon come into general use. In one respect, however, the practice as stated strikes me of questionable equity, if not expediency, and I would like to ask what has been the effect upon your revenue of the lowest rates for summer service?

Mr. Insull: We do not know yet. We only put it in operation during the last few weeks.

Mr. Weeks: It seems to me that it is somewhat inequitable to make a lower rate for transient summer service, such as the customer who operates a fan but a few weeks or months at most in the year, while his rate on account of the interest factor should be higher rather than that for most other classes of service.

Mr. Insull: We have a large by-product that we want to sell, which usually lies idle in the summer; and we endeavor to dispose of it to these occasional users.

Mr. Weeks: What has been the effect of the Wright system, which is admirable, and will undoubtedly be the system of the future, upon municipal lighting? What would be the rate on municipal lighting, run as the average municipal light does?

Mr. Insull: It would be very low.

Mr. Weeks: Have you determined that?

Mr. Ferguson: The municipal light runs about 12 hours. It depends whether it is a moonlight schedule or an all-night service. It would not get as low as you are selling it now. You can readily see that if you make the rate 20 cents the first hour, and 10 cents for everything after that, the maximum discount will not reach 50 per cent. It is something higher than that now. It is the same as if you figure 10 cents per kilowatt-hour. You will have to make the second rate low enough so as to figure out the same kilowatt-hour as you are now charging for the arc-light service. That must be arranged in each individual city.

American Institute of Electrical Engineers.

The fifteenth general meeting of the Institute will be held at the Millard Hotel, Omaha, Neb., beginning on Monday, June 27th, at 10 a. m. Daily sessions from 10 a. m. to 1 p. m. will be held on Tuesday, Wednesday and Thursday, and the following papers will be presented:

"Inaugural Address," by the president, Dr. A. E. Kennelly of Philadelphia.

"The Dielectric Strength of Air," by C. P. Steinmetz of Schenectady, N. Y.

"Two-wire Distributing Systems and Lamps at 220-240 Volts," by John W. Howell of Newark, N. J.

"A Capillary Electrometer for Electrical Measurements," by Charles F. Burgess of Madison, Wis.

"Alternating-current Transformers from the Station Manager's Viewpoint," by W. F. White of Omaha, Neb.

"The Graphical Treatment of Alternating Currents in Branching Circuits, with Special Reference to the Case of Variable Frequency," by Dr. H. T. Eddy of Minneapolis, Minn.

"Some Phases of the Rapid-transit Problem," by Albert H. Armstrong of Schenectady, N. Y.

"The Evolution of the Line Signal," by Arthur V. Abbott of Chicago.

"The Commutated Curve of a Composite-wound Alternator," by D. C. Jackson of Madison, Wis.

"Alternate-current Working for Laboratory and Testing Purposes," by Harris J. Ryan of Ithaca.

"High-voltage Power Transmission," by Charles F. Scott of Pittsburg, Pa.

"Preliminary Report of Committee on Standardization," by Dr. Francis B. Crocker, chairman.

"Transmission and Distribution of Power for Railway Service," by Ernst J. Berg of Schenectady, N. Y.

"The Education of Electrical Apprentices and Journeyman," by Arthur A. Hamerschlag of New York.

"Air Gap and Core Distribution—The Magnetic Flux and its Effect upon Regulation and Efficiency of Dynamo-electric Machinery," by W. E. Goldsborough of Lafayette, Ind.

"The Imperial Electric-light, Heat and Power Plant of St. Louis," by George A. Damon of Chicago.

"Some Tests with an Induction Generator," by A. F. McKissick of Auburn, Ala.

Members may avail themselves of the special excursion rate fixed for the Trans-Mississippi Exposition, which is $14.75 from Chicago to Omaha, or $48.50 from New York to Omaha. These round-trip tickets will be good until July 5th, or by special endorsement until August 30th.

Rooms at the Millard Hotel, which will be the Institute headquarters, are from $1.50 upward on European, and $3 upward on the American plan. Rooms will be reserved for members, but, to avoid misunderstanding, notice should be sent direct to hotel.

The secretary announces that members from Chicago and the East should arrange to leave Union Station, Chicago, by the 5:50 p. m. train on the Chicago, Burlington and Quincy railroad, Sunday,

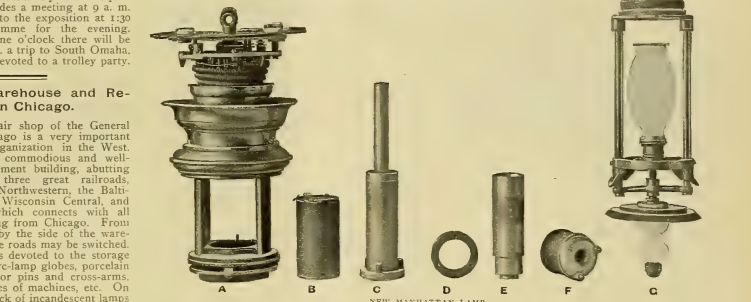
June 26th. In order to make this connection, members from New York and the East should leave New York city by the 1 p. m. train on the West Shore railroad, Saturday, June 25th, which is due at Chicago at 4 p. m. on June 26th.

Special cars will meet the delegates at the depot in Omaha on Monday morning and will take them to the Millard Hotel for breakfast. At 9 a. m. the Institute will meet in the Bee building, 1706 Farnam street, and at 2 p. m. there will be an excursion to the Omaha Smelting Works and Union Pacific shops. At 7:30 p. m. a complimentary initiation by the Knights of Ak Sar Ben will take place. The programme for Tuesday includes a meeting at 9 a. m. and a complimentary trip to the exposition at 1:30 p. m., and special programme for the evening. Wednesday morning at nine o'clock there will be a meeting, and at 1:30 p. m. a trip to South Omaha, while the evening will be devoted to a trolley party.

General Electric Warehouse and Repair Shops in Chicago.

The warehouse and repair shop of the General Electric company in Chicago is a very important part of that company's organization in the West. These branches occupy a commodious and well-lighted six-story and basement building, abutting on the main lines of three great railroads, namely, the Chicago and Northwestern, the Baltimore and Ohio and the Wisconsin Central, and also on the Belt line, which connects with all the other railroads radiating from Chicago. From these, into a special spur by the side of the warehouse, the cars of any of the roads may be switched.

The top or sixth floor is devoted to the storage of unbroken packages of arc-lamp globes, porcelain and glass isulators, insulator pins and cross-arms, armatures of the older types of machines, etc. On the fifth floor is stored a stock of incandescent lamps in original packages ready for immediate shipment, fan motors, arc-lamp globes in broken lots, arc-lamp carbons, etc. At present the incandescent lamps in stock number roughly about 500,000, and this number is kept constantly on hand by weekly shipments from the Edison Lamp Works of Harrison, N. J. The fourth and third floors are laid out in floor bins and wall cupboards, the latter divided into pigeon-hole boxes ready for immediate shipment. Each bin and each pigeon-hole bears the catalogue number of the device or part it contains, and so well is the arrangement that a boy could fill from the bins and cupboards any order for supplies, large or small. On the fourth floor are the larger wiring supplies and parts, arc lamps—single and double-carbon series and open and enclosed arcs for direct or alternating circuits—car resistances and meters and type "H" transformers of all sizes in the original Electric company; suffice it to say, that no order, however large or insignificant, but can be filled from this stock. The second floor contains the repair shop, fully equipped with lathes, planers, drill presses and shapers, all driven by electric motors. The front part of this room is given up to the armature-rewinding department. On this floor is located also an elaborate meter, lamp, and transformer-testing department, as well as a dip room and polishing room for refinishing arc-lamp casings, etc. On the first floor are stored all the heavy machines—generators, motors and the large-sized transformers.

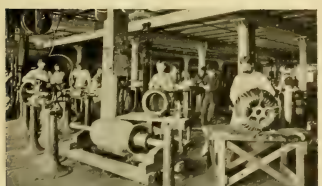


NEW MANHATTAN LAMP

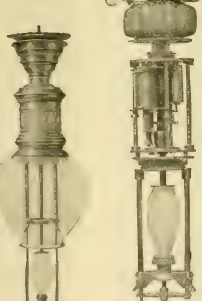
This is also the shipping and receiving room for all the stock, and one corner is devoted to the office, while in the rear is a small carpenter shop, with planer and a circular saw, driven by a five horse power motor. An overhead track equipped with traveling-chain hoists runs above this floor and out over both railroad tracks and the street, and greatly facilitates the shipment or reception of the cases of supplies or apparatus. Along one side are large bins, each labeled with the name of a railroad or express line. In these bins are placed the cases for shipment, so that they may be shipped out rapidly without confusion or mistake. By a special arrangement with the express companies, four shipments, the last at 6 p. m., are made daily. Thus express orders leave the warehouse the day they are received at the office.

The warehouse was arranged and is under the care of George M. Ellis.

View of Warehouse


View of Repair Shop

GENERAL ELECTRIC WAREHOUSES AND REPAIR SHOPS


NEW MANHATTAN LAMP

factory boxes ready for reshipment at the shortest notice. In the bins on the third floor are the smaller wiring supplies and parts—fuses, sockets, switches, cut-outs, lightning arresters, arc-lamp parts, dynamo-motor parts, brushes, both copper and carbon, line material of all kinds, controller parts, rheostats, assembled commutators and a full stock of the new GA motors, as well as a heavy stock of insulated cord and wire. The attempt to enumerate all the devices kept in stock in this warehouse would be to transcribe the supply catalogue of the General

The basement contains the power plant, consisting of two 80 horse power boilers and two horizontal engines, one of 100 horse power, used for dynamo-testing purposes, the other, a 50 horse power engine, belted to a direct-current machine from which the lighting and power current used in the building is supplied and to a 30 kilowatt alternator used for meter and other testing purposes. The basement also contains a boiler-feed pump, a water heater, a large fire pump, four large steam head blocks for baking armature and dynamo field coil, and a switchboard divided into three sections equipped for testing high-tension series arc machines, direct-current, low-tension machines and alternating testing work. The load for the first consists of a bank of arc lamps, also in the basement, for the second a large water rheostant under the sidewalk, and for the alternating section a large bank of incandescent lamps on the second floor. Beneath the sidewalk is kept a large stock of insulating oil for transformers. The different floors are connected by a four-ton elevator.

The repair shop is in charge of L. G. Crawford.

New Manhattan Lamp.

Many changes have been introduced in the design and construction of the new Manhattan enclosed arc lamp, although many of the features of the old type were found so valuable that they were retained. The principal changes are briefly outlined herewith:

The length of 36 inches has been reduced to 29 inches.

New lamps may be furnished to take the old style of trim, or the new style of trim may be furnished for old lamps now in service.

The novel feature of lowering the bulb down through the opening in the bottom of the outer globe on double telescoping rods has been introduced.

The cap used in the new Manhattan lam is provided with a gas chamber, which materially lengthens the life of the carbon.

The mechanism shell may be lowered while the lamp hangs in position by removing the trim and outer globe and giving the central cylinder a quarter turn, when the shell may be removed and current adjustment of the lamp changed.

The adjustment of the rheostat for voltage may be made by loosening set screws and lowering the split canopy at the top.

All the mechanism below the armature has been dispensed with, and the only moving part in the lamp is the armature, inside of which, however, is a ball clutch. The armature and clutch may be removed from the lamp while it hangs in position by undoing one nut.

One of the sources of danger to short arc lamps has been that the arc is so close to the mechanism that there is a likelihood of burning out of magnet. This has been provided against by the use of a ventilated magnet, and a current of air is constantly passing between magnet and central tube.

The steady burning of the old type lamp depended absolutely upon perfection of the air chamber, which caused variation in burning of different lamps, also great nicety of manufacture, and it was impossible to make lamps altogether interchangeable. In the new lamp there is no such chamber, and a loose fit is maintained between all of the parts. In addition to the air chamber, in which the armature works in the old lamp, a further chamber was provided around the clutch, making it necessary to take the shell off in a most convenient manner, and great care had to be used in replacing insulation at this point, which made the old lamp most difficult to assemble. This has also been remedied in the new lamp.

To remove the magnet the lamp may remain hanging in position. The operator should take off globe and frame G, unscrew cap F, when there may be taken out the armature E; then unscrew the nut D, and the central tube C and the magnet B may be slipped out of the frame A, and every part of the lamp is separated. The lamp may be assembled by the reverse operations.

By an improvement in the electrical and mechanical design of the magnet and armature, the new lamp will be found to burn within very narrow limits and with great steadiness.

The new type Manhattan lamp has been designed for service on circuits of 220 volts, and the same lamp can be transferred from a 110 to a 220 volt circuit by the substitution of another coil and rheo-

stat and a change of the nut holding the armature. The same standard new type Manhattan lamp is also arranged to burn two or more in series on circuits of from 200 to 600 volts by a change of the magnet coil.

The new-type Manhattan alternating enclosed arc lamp contains a different form of mechanism, but the trimming device, outer globe, gas-check plug, carbon sheath and shell are the same as used on the direct-current lamp, and these parts of the two lamps are interchangeable. The trim of the old-type Manhattan lamp is also interchangeable with the new

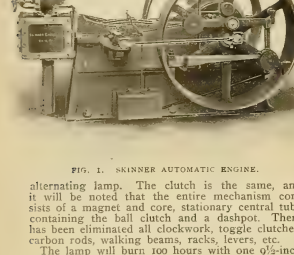


FIG. 1. SKINNER AUTOMATIC ENGINE.

alternating lamp. The clutch is the same, and it will be noted that the entire mechanism consists of a magnet and core, stationary central tube containing the ball clutch and a dashpot. There has been eliminated all clockwork, toggle clutches, carbon rods, walking beams, racks, levers, etc.

The lamp will burn 100 hours with one 9½-inch by ½-inch upper and one six-inch by ½-inch lower carbon, and the unburned portion of the upper may be used as a lower for the next run. On circuits of 100 volts and six amperes the lamp consumes 450 watts. The length of the lamp is 29 inches.

The lamp may be adjusted by a simple change

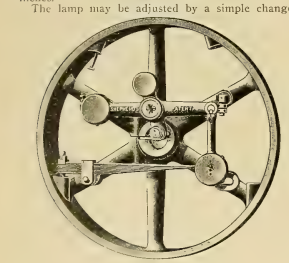


FIG. 2. SKINNER AUTOMATIC ENGINE.

of connections on the top plate for circuits of from 7,000 to 17,000 alternations, and has a range of adjustment for voltage of from 90 to 130 volts.

The outer globe is suspended on a white enameled ring about 7½ inches in diameter, and being directly over the arc acts as a reflector and materially increases the efficiency of the light.

One special point in connection with this lamp is that the carbon sheath is removable from the lamp.

These Manhattan lamps are manufactured under

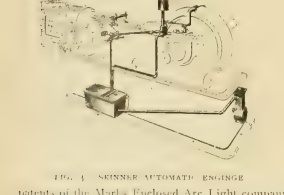


FIG. 3. SKINNER AUTOMATIC ENGINE.

patents of the Manhattan Enclosed Arc Light company, Messrs. Odum, Mas Harris and others.

Death of Stanley S. Stout.

Stanley S. Stout died at the Meadow Brothers' Hospital last Saturday after a short illness. He was a patent lawyer and for six years served as an examiner of applications in the United States Patent Office. During recent years his practice has been largely in the field of telephone litigation, and he conducted the defense of the Western Telephone Construction company when the Bell interests attempted to enforce the Watson patents. That litigation resulted disastrously for the Bell interests, the court declaring the patent to have been worthless. Mr. Stout was a prominent member of the Marquette Club of Chicago.

Skinner Automatic Engine.

The accompanying illustrations represent the Skinner self-oiling automatic engine, which, outside of its handsome design and massive proportions, has many features of exceptional merit. The engine uses the slide valve, balanced within 20 per cent., and is guaranteed to remain steam-tight for five years without any attention from the operator. This valve is operated by a governor of peculiar construction, consisting of an eccentric arm, weight and spring. Mounted in a wheel on frictionless roller bearing, requiring no lubrication, it is the only type of governor that will maintain perfect regulation in which friction is entirely eliminated. Its regulating qualities, the manufacturers say, are remarkable, as it will maintain the same regulation with steam pressure ranging from 30 to 100 pounds.

The speed of engine can be changed 40 per cent. by simply bolting on or taking off weights, and maintain the same regulation, without any other adjustment of the governor. The manufacturers guarantee that this governor will maintain a regulation within one-half of one per cent., and that the whole load may be thrown on and off the engine instantly, without affecting the regulation over one per cent. The engine will reserve normal speed in six revolutions of the shaft.

The cuts show the engine, Fig. 1, provided with an outside connected governor, Fig 2. Engines are also built with the valve operated by inside connected governor with eccentric on the shaft.

A new system of lubrication is employed, the different parts of which are fully shown in Fig. 3. It furnishes a constant stream of pure oil to every bearing, and in full sight of the operator. After leaving the engine the oil and entrained water coming from the stuffing box are separated, the oil returned to the supply tank on the side of the subbase, which is provided with a filter in which the oil is purified to be returned to the engine in a pure condition.

The engine is just as accessible for examination or adjustment as any other. Any part can be got at in a moment. The manufacturer guarantees that not one particle of oil will reach the exterior of the engine or foundation, and that an engine of 50 horse power can be operated 10 hours per day for one year on a consumption not to exceed five gallons of new oil, which is added from time to time, as required, and at no time will the oil in use show more than one-quarter of one per cent. more friction than the oil taken from the barrel.

The devices that go to make up this system consist of jointed oil feeders, which can be lifted away from the parts oiled, a noiseless positive motion pump, supplying the reservoir above the engine with oil. The pump has 10 times the capacity required. Oil not used is returned to the supply tank through an overflow pipe. An oil and water separator and filter and supply tank are used.

Every part of this oiling apparatus is in plain sight of the attendant, and there is no possibility of clogging and no filtering material to interfere with the circulation of oil. The oil feeders can be removed from the engine by simply unloosening three set screws.

This engine is manufactured by the Skinner Engine company of Erie, Pa.

New York Electrical Society.

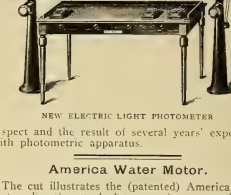
The following-named members of the New York Electrical society, who have changed their places of residence, are requested to send their new addresses to the secretary, No. 120 Liberty street, New York:

B. F. Sherman,	L. J. O'Reilly,
R. S. Dobbie,	A. V. Wahlron,
D. D. Book,	Harry Tetlie,
H. Van Sands,	C. A. Thompson,
Fred Reed,	E. E. Stark,
C. W. Raymond,	J. T. Palmer,
W. F. Collins,	T. F. Grover,
C. E. Hart,	J. C. Henry,
J. Egan,	J. W. Doyle,
G. C. Webb,	R. Varley,
D. H. Washburn,	C. H. Wright,
J. C. Harris,	C. C. Gartland,
W. Schwein,	John Deane, Jr.,
A. S. Miskin,	F. E. Dobbie,
J. W. Meagran,	C. A. G. Groenbeck,
Meno Fedden,	James Stewart,
W. A. Giles,	C. F. Green,
Thomas Bennett,	M. W. Grovesteen,
T. A. Fowler,	G. Arnold,
S. J. Harris,	J. S. Cobb,
C. E. Chimock,	D. H. Starratt,
R. Crawford,	E. Voelckel,
A. C. Greenburg,	G. R. Shepard,
R. F. Bird,	W. L. Tamblyn,
A. B. Bennett,	A. Stumm,
N. Hall,	C. J. Bickley,
J. D. Underhill,	H. R. Niles,
J. A. Cabot,	J. McMahon,
W. E. Lamb,	E. S. Reid,
E. Deming,	J. H. Longstreet,
R. A. Mitchell,	M. E. Modder,
B. Lichtman,	C. P. Gott,
H. A. Dingle,	A. C. Barrett,
C. Hermon,	A. W. Steiger,
Leo. Rock, Jr.,	E. C. Miller,
H. F. Solomon,	A. McKinnon,
A. G. Holcombe,	

H. C. Sterling, proprietor of the electric-light plant at Huron, S. D., is preparing to change the power from artesian-well water to gasoline engines.

New Electric-light Photometer.

Considerable advancement has been made in photometry as applied to electric lighting, and the latest apparatus placed on the market by Queen & Co. embodies many novel features that will commend it to central-station managers. To begin with, it is a departure from the usual design, as the cut shows. Cast-iron pedestals support the metal photometer bar and carry stages for the support of the lights, screens, etc. The rheostat shown on the left-hand pedestal is for the control of the potential on the standard. It has about 800 or 1,000 steps and permits of perfect adjustment. A similar rheostat on the right regulates the current on the test lamp. The graduated bar is inclined at an angle of 45 degrees, in which position the graduations are lighted by the lamp under test. The screen, which may be of either the Bunsen or Lummer-Brodhun type, is mounted on a truck and may be rolled along the bar wherever desired. A milled head permits of close adjustment when balance is nearly attained. The instrument is said to be complete in every



NEW ELECTRIC LIGHT PHOTOMETER

respect and the result of several years' experience with photometric apparatus.

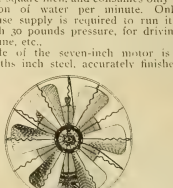
America Water Motor.

The cut illustrates the (patented) America water motor directly attached to a 12-inch brass fan, as manufactured by the A. Rosenberg company, Baltimore, Md. This is said to be the only water motor in the world that is made to tilt or adjust in any direction. These motors are made in two sizes at present—seven inches diameter and nine inches diameter. Both are provided with the polished brass ball and clamp ring for permitting the adjustment or tilting after the motor has been fastened in place or on brackets.

The base or stand is supplied with a leather or felt packing ring, as well as the clamp ring or yoke, making a smooth, water-tight joint between the brass ball and the base or stand, also preventing the brass ball from becoming abraded.

The seven-inch size is especially designed for fan service, or for running a sewing machine, a small dynamo, a telephone exchange generator, a dentist's engine, or other light machinery, such as jewelers' lathes, physicians' centrifugal machine, etc. This seven-inch motor will run about 2,000 revolutions per minute with water pressure at about 60 pounds per square inch, and consumes only seven-eighths gallon of water per minute. Only the ordinary house supply is required to run it satisfactorily, with 30 pounds pressure, for driving fan, sewing machine, etc.

The spindle of the seven-inch motor is made of three-eighths inch steel, accurately finished and



AMERICA WATER MOTOR.

journaled in the very best anti-friction metal made, which can be easily renewed when worn, and the special construction has produced, it is claimed, the only motor that will not leak at the bearings. Motors are provided with two bearings and two oil cups, and have a set-screw of brass at the back of the bearing to adjust the spindle and take up any vibration occasioned by wear.

Canadian Electrical Association.

The annual meeting of the Canadian Electrical association will be held at the Windsor Hotel, Montreal, on June 28th. Following is a list of the papers to be read on that occasion:

"How to Overcome Some of the Difficulties Encountered by Central-station Men." By A. A. Wright.

"The Quimby Screw Pump." By W. T. Bonner.

"Experiences of an Inspector." By Dr. J. K. Johnstone.

"The Electric Current in the Rainy River Gold Mines." By M. W. Hopkins.

"The Importance of Proper Methods of Illumination." By F. A. Bowman.

"Electric Utilization of Water Powers." By Louis DeWitt Magie.

"Economies in the Boiler Room." By James Milne.

"The Unconscious Ownership of an Important Key"—(A Plea for the Introduction of Goods Traffic on Our Suburban Tramways). By W. T. Bonner.

CORRESPONDENCE.

New York Notes.

New York, June 20.—When there is little other technical news in town, there is always the rapid-transit situation to fall back on. That, like the poor, is always with us. Mr. Gould, of the Manhattan company, and Mr. Orr, of the Rapid Transit commission, are still bombarding each other with letters intended for public consumption. Indeed, Mr. Gould complains in his last letter that he has not received a letter addressed to him and published in the daily papers, although he waited several days. Now he wants the letter, if it is intended for him, and also a reply to his company's latest counter-proposition. And so it goes. It is all very tiresome, and there is no real advancement toward a substantial improvement in the rapid-transit facilities of this city.

A rather curious question, in which is involved a lessee's right to bring electric-light wires into leased property containing an isolated plant, came up in court on Saturday. Colonel Edward L. Langford, who is the receiver of the Brighton Beach Railroad company, leased the Brighton Beach Hotel for the season of 1898 to Patrick H. McGann for $6,000. McGann paid $3,000 in advance. His lawyer moved, at a special term of the Supreme Court before Justice Maddox, for an order enjoining Langford from interfering with the Edison Electric Light company and the Brooklyn Gas company in furnishing lights for the hotel. The counsel said that unless the lights were put in the hotel would be in darkness, and a total loss to the lessee. The receiver's attorney said that the proceeding was an attempt to lay pipes or wires on private property without due compensation to the owner. The grounds about the hotel would be torn up, and they had not been leased by McGann. It was contended also that there is now in existence a plant sufficient to furnish lights for the hotel, and the new scheme of the lessee is an unnecessary one. Justice Maddox said that he did not think the receiver could force the lessee to buy lights from the owner unless there was such a provision in the lease. He took the papers and reserved his decision, remarking as he did so that he thought the plaintiff is entitled to put lights in the hotel if he wants to do so. M. S.

PERSONAL.

H. G. Underwood, the patent lawyer of Milwaukee, was in Chicago on Monday, in attendance at the funeral of his former partner, Stanley S. Stout, who died last week.

Mr. E. L. Brayton, one of the officers of the Pelton Water Wheel company of San Francisco, who has been at the company's eastern works for some weeks past, recently sailed for Europe for an extended trip abroad.

P. J. Hertz of the New York office of the Ericsson Telephone company is in Chicago. Mr. Hertz has been in the West some time. He will represent the Ericsson company at the telephone convention in this city on June 30th.

ELECTRIC LIGHTING.

The village of Le Roy, N. Y., has been and is having much trouble with the gas and electric-light question, but the village continues to operate the much-discussed plant. New complications have arisen, which promise to prolong the settlement of the dispute and add to the expense. Many months are likely to pass before it is known definitely whether or not the village will have to retain possession of the plant. Judge White has appointed Hon. Charles M. Tabor of Buffalo to take evidence and submit a report to the court as to what restitution the village of Le Roy should make to the gas company for the use of its plant since possession was taken, which was December 1, 1897. As yet the referee has not given his report, but in the meantime the Le Roy Gas Light company has appealed from the decision of the Supreme Court, which set aside the proceedings by which it was proposed that the village should acquire the plants for lighting. This appeal will be argued in the Appellate Division of the Supreme Court in September. In the meantime the village will probably continue to operate the plants.

ELECTRICAL SECURITIES.

The Edison Electric Illuminating company of Brooklyn has declared a quarterly dividend of 1½ per cent., payable July 15th.

The American Bell Telephone company has declared a quarterly dividend of three per cent. and an extra dividend of 1½ per cent., payable July 15th.

The Southwestern Telegraph and Telephone company has certified to the secretary of state at Albany that it has increased its capital stock from $4,000,000 to $5,000,000. The liabilities of the company are stated to be $431,000.

A certificate has been filed with the secretary of state stating that the Edison Electric Illuminating company of Brooklyn has increased its capital stock from $4,000,000 to $5,000,000. The liabilities of the company are placed at $2,312,118.

The North American company, which figured conspicuously in the Villard deals a few years ago, has made a report showing that its gross earnings last year amounted to $10,845 more than the previous year, and that its expenses were cut down $949 in the same period.

Dickinson MacAllister, receiver of the Metropolitan West Side Elevated Railroad company, in his monthly statement filed in the United States Circuit Court, showed that the receipts of the company during May were $345,361.34 and the disbursements were $86,799.01, leaving a cash balance of $258,562.33. The cash balance from April was $241,863.79. During May the railroad fares amounted to $99,410.50, while rentals and privileges produced $4,087.05.

TECHNICAL SCHOOLS.

At the Johns Hopkins University commencement last week certificates of proficiency in applied electricity were awarded to nine men.

Daniel W. Church, late of Rensselaer Polytechnic Institute, has been appointed professor of engineering in Lewis Institute, Chicago.

The graduating class of the Rensselaer Polytechnic Institute of Troy numbered 27. The degree of civil engineer was conferred upon 25, and two received the degree of bachelor of science. Three of the members of the class are in the war.

Princeton conferred the degree of electrical engineer on two members of the graduating class at the commencement on June 15th. Forty-six members of the class received the degree of bachelor of science and 13 the degree of civil engineer.

A class of 23 was graduated at the Rose Polytechnic Institute of Terre Haute, Ind.—18 in electrical engineering, four in civil engineering and one in chemistry. The Hemenway gold medal for the highest standing in the graduating class for the four years went to Henry Stilz of Louisville.

MISCELLANEOUS.

The Canadian Electrical News for June contains several interesting articles on general topics and considerable convention matter. It is a very creditable number.

TRADE NEWS.

Mr Henry A. Coit has taken charge of the southern office of the Sterling Electric company of Chicago, with headquarters in the Laclede building, St. Louis. In addition to exploiting the products of the Sterling company, Mr. Coit will handle high-grade telephones and line supplies, including everything used in the equipment and maintenance of a telephone exchange and toll line.

Kurz & Root, consulting electrical engineers of Appleton, Wis., have recently added an electrical repair shop to their factory, and are now prepared to make repairs, such as rewinding armatures, fields, transformers, repairing and standardizing burned-out or defective electrical instruments. They are also prepared to send electrical experts to examine any part of their customers' plants or make repairs in the stations.

The Goubert Manufacturing company, 14 and 16 Church street, New York, has secured from the Metropolitan Street railway company of that city the contract for feed-water heaters for the mammoth power station being erected at Ninety-sixth street and East River. The first installment consists of 30,000 horse power in six heaters, horizontal type, and rated at 5,000 horse power each. They are to be placed between the low-pressure cylinders and the condensers. This contract is said to cover the largest single order for feed-water heaters ever placed in this or any other country.

The annual meeting of the stockholders of the Siemens & Halske Electric company of America was held on Thursday, June 16th, at the office in Chicago. Nearly the entire capital of the company was represented at the meeting, and the following-named gentlemen were elected directors of the company: Charles T. Yerkes, Martin Maloney, John R. Bartlett, R. Suydam Grant, Charles E. Yerkes, E. A. Moore, B. W. Grist, Howland Coit, W. L. Elkins, Jr. The new board of directors was organized, and officers were elected as follows: President, Charles E. Yerkes; secretary and treasurer, W. T. Block; assistant secretary and assistant treasurer, C. F. Marlow; general manager, B. W. Grist. The following-named gentlemen compose the executive committee: Martin Maloney, Charles E. Yerkes, J. R. Bartlett.

An important combination in the rheostat business has just been consummated by the consolidation of the Cutler-Hammer Manufacturing company of Chicago with the American Rheostat company of Milwaukee, both companies being well known to the electrical trade. The business will be carried on under the name of the Cutler-Hammer Manufacturing company at 70-80 West Jackson street, Chicago. The capital stock of the combined company has been increased to $75,000, and a large proportion of the increase has been invested in new machinery. With its increased manufacturing facilities and larger capitalization the company will be able to take care of its rapidly increasing business in a prompt and satisfactory manner. The officers of the new company are as follows: President, F. R. Bacon; vice-president, F. L. Pierce; secretary and treasurer, J. G. Hickcox; electrical engineer and general manager, H. H. Cutler.

The Diehl Manufacturing company of Elizabethport, N. Y., makes this announcement to the trade: "Our policy has always been, and still is, not to trouble the public with patent litigation so long as it could possibly be avoided. Certain manufacturers have, however, taken advantage of this policy by offering electric fans which, we are advised, infringe so many of our patents that we are bound to enforce our rights. Accordingly, we have commenced suit against Rice & Marean of Washington, under the following patents: No. 465,360, dated December 15, 1891; No. 465,361, dated December 15, 1891; No. 537,679, dated April 16, 1895; No. 585,250, dated June 29, 1897. As soon as these patents are judicially sustained, we will proceed against all dealers in and users of infringing fans for damages and injunction. We believe it our duty to the public to give publicity to the above facts, so that no one shall unknowingly run up a bill of damages, and so that everyone who does not wish to do so may be on his guard against becoming an infringer."

BUSINESS.

A neat booklet calls attention to the merits of the Wurts lightning arresters. It is issued by the Westinghouse Electric and Manufacturing company of Pittsburg, which will send additional information on request.

The Western Electric company desires to advise the central stations using alternating current apparatus that it will be pleased to quote prices on the Lakon transformers and Lakon cut-outs for transformers.

The Peerless Rubber Manufacturing company of 16 Warren street, New York, and 202 South Water street, Chicago, claims that its Rainbow and "Honest John" steam packing is unequaled. A number of flattering testimonials seem to bear out the statement.

The installation of chloride accumulators in the electric-lighting plant at the residence of John A. Brown, Jr., Esq., near Wayne, Pa., forms the subject of a recent circular issued by the Electric Storage Battery company of Philadelphia. Several illustrations supplement the text.

The Warren-Medbery company of Sandy Hill, N. Y., manufacturer of inductor alternators, reports a flattering demand for its machines. The strong points of the Warren-Medbery apparatus are becoming widely known, and the company has installed a number of machines during the last two weeks.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 14, 1898.

605,478. Automatic Stop Mechanism for Printing Presses. George Gibbs, Milwaukee, Wis., and Irving Stone, Chicago, Ill. Application filed June 12, 1897.

The mechanism is adapted to operate upon a continuous web or strip of material [illegible] feeding the [illegible] stopping device, a magnet for operating said stopping device, having [illegible] connected with a source of current, a circuit controller normally closed and short circuiting the magnet, and a movable device normally supported by the web or strip and arranged when ever the web or strip is severed or slackened to open the circuit controller and thus cause the magnet to be energized.

605,485. Brake for Trolley Cars. Aloysius H. Klingler, Ridley Park, Pa. Application filed February 20, 1897.

A combined brake and fender is provided comprising standards adapted to be [illegible] a car-truck frame and having slots of different radii [illegible] the upper and lower portions thereof, brake shoes provided with cross bars to [illegible] and the shoes having grooves or recesses in the walls of the same of different radii as to the upper and lower portions thereof, pins carried by the shoes and standards for engaging and moving in the slots and grooves respectively of the standards and shoes and means for actuating the brake shoes in the slots of the standards.

605,498. Incandescent Electric Lamp. Otto H. Michaelson, Charleston, W. Va. Application filed July 17, 1897.

A base of insulating material having an [illegible] groove in its outer end, a metal shell in which the [illegible]

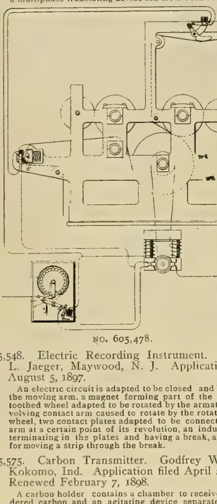
secured, conductor wires extended through the base piece, a ring of insulating material in the shell, a metal ring on the insulating ring and with which one of the wires connects, a metal ring in the insulating ring and with which the other wire connects, a globe having a channel around the wall of its open end, and a packing ring engaging the channel and in the groove of the base.

605,525. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed January 28, 1895.

A dynamo-electric machine is utilized having out-of-phase coils connected to three collector rings, and the remaining terminal of one coil connected to an intermediate point in the second coil, and a fourth collector ring likewise connected to the intermediate point in the last-named coil.

605,526. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed June 17, 1897.

The arrangement includes a generator having a main coil and a supplemental coil at an angle thereto connected at one end to an intermediate point in the main coil, a three-wire distribution system fed from the main coil, and a multiphase translating device fed from both coils.



NO. 605,478.

605,548. Electric Recording Instrument. Charles L. Jaeger, Maywood, N. J. Application filed August 5, 1897.

An electric circuit is adapted to be closed and broken by the moving arm, a magnet forming part of the circuit, a toothed wheel adapted to be rotated by the armature, a revolving contact arm caused to rotate by the rotation of the wheel, two contact plates adapted to be connected by the arm at a certain point of its revolution, an induction coil terminating in the plates and having a break, and means for moving a strip through the break.

605,575. Carbon Transmitter. Godfrey W. Goss, Kokomo, Ind. Application filed April 20, 1897. Renewed February 7, 1898.

A carbon holder contains a chamber to receive the powdered carbon, and an agitating device separate from the carbon holder is arranged within the chamber thereof for agitating the powdered carbon in the chamber, independently of any movement of the carbon holder.

605,580. Telephone Circuit and Apparatus. Milo G. Kellogg, Chicago, Ill. Application filed March 23, 1887.

A metallic circuit between two stations includes the secondary coils of two translators, one at each station, each translator containing a core and a primary coil and a secondary coil each wound around the core, each secondary coil having two parts and having its inductive center determined, and each point or portion of each part having a corresponding point or portion in the other part, which pairs of points or portions are equivalently in the same position with relation to every point or portion of the core, in combination with another circuit into which the metallic circuit is connected at the two inductive centers of the translators.

605,592. Letter box. Miletus J. Wine and Charles A. Thompson, Washington, D. C. Application filed April 17, 1897.

A signal-box is located adjacent to the letter-box; a hinged lid on the letter-box is provided with an arm, and a door on the letter box is provided with an arm and an electrical circuit, oppositely disposed electro-magnets in the circuit within the signal-box, a pivotally supported armature, a [illegible] arranged to contact with the poles of the magnet and engage the signal with its free end to move the signal into and out of sight, and contacts in the circuit within the letter-box in the path of the arms on the lid and door thereof to make and break the circuit.

605,594. Telephone Receiver. Peter C. Burns, Chicago, Ill. Application filed November 20, 1897.

The instrument comprises a permanent magnet, a collar mounted thereon, a diaphragm cap, a diaphragm and a cup-shaped member to which the diaphragm and cap are secured, and a screw connection between the cup-shaped member and the collar whereby the diaphragm may be adjusted in proper position relative to the pole piece, together with a disk on the collar and stop screws in the disk adapted to bear against the cup-shaped member and lock the parts in adjusted position.

605,615. Ore Stamp. David M. Smyth, Pasadena, Cal. Application filed Jun[illegible] 1897.

The combination [illegible] and the electromagnets for actuating the [illegible] that is actuated by an upward movement [illegible] stamp to change the circuit connection for [illegible] stamp.

605,631. Electrically Driven and Moved Plow. Erich Dallmann, Neu[illegible]dz, Germany. Application filed October 9, 1897.

Shafts are arranged behind each other driving a plurality of conical plow [illegible] frames, pendulously suspended at those shafts and coupled by guide-bars, plow-screws at the lower end of driving shafts, the latter being lodged at the frames in such a manner as to be prevented from coaxial shifting and means for adjusting and securing the frames.

605,659. Automatic Apparatus for Telephone Switchboards. Julius H. West, Berlin, Germany. Application filed July 8, 1896.

An automatic switch apparatus for telephone exchanges consists of the combination with the plug or connection cords, the operator's telephone and the call battery, of a number of contacts inserted in the connecting cords, a shaft continuously rotated by a suitable motor, disks loosely mounted on the shaft and having suitable cam surfaces, means for coupling the disks with the shaft automatically by the action of lifting up the connection plug, and means for operating the contacts by the rotation of the disks.

605,661. Insulating Electrodes for Electric Gas-lighting Burners. Adrian L. Bogart, Jamaica, N. Y. Application filed May 5, 1897.

One of the electrodes is formed of a metal wire or strip and there is an insulating shield through which the wire or strip is threaded.

605,663. Electric Railway. Charles H. Davis, New York, N. Y. Application filed November 2, 1897.

A line is divided into insulated divisions; signal devices are respectively located between the successive divisions; means are provided for actuating the signal devices successively to give a definite indication, and means are also provided controlled by each signal device for then establishing electrical circuit in the line divisions between which it is located.

605,664. Combined Train-arresting and Signaling Mechanism for Electric Railways. Charles H. Davis, New York, N. Y. Application filed November 9, 1897.

The combination is described in an electric railway of a line conductor and an electric motor vehicle, a contact arm on the vehicle normally closing circuit between the vehicle motor and the line conductor, and a brake mechanism on the vehicle controlled by the arm; the aforesaid parts being constructed and arranged so that when circuit is open between the contact arm and the conductor the brake mechanism shall be controlled thereby to arrest the motion of the vehicle.

605,665. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed August 6, 1897. Renewed May 18, 1898.

An electric meter is provided with an annular armature, coils exterior to the armature connected in circuit, a cross-shaped magnetic core within the armature, coils on two poles of the core, also connected in circuit and closed circuits on the other poles of the core.

605,670. Telephone-switchboard System. Fred C. Hughes, Detroit, Mich. Application filed July 3, 1897.

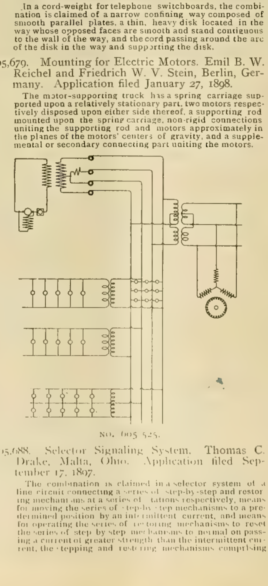
The supporting rod is common to all of the springs of the jack, an insulating covering upon the rod flattened upon one face, a series of springs mounted upon the insulating covering having an aperture therein provided with a straight face which coincides with the flat portion of the insulating covering, a series of insulating collars mounted upon the insulating covering of the rod and interposed between the springs, and the nuts on the ends of the rod for binding the parts together.

605,671. Cord Weight for Telephone Switchboards. Fred C. Hughes, Detroit, Mich. Application filed September 27, 1897.

In a cord-weight for telephone switchboards, the combination is claimed of a narrow confining way composed of smooth parallel plates, a thin, heavy disk located in the way whose opposed faces are smooth and stand contiguous to the wall of the way, and the cord passing around the arc of the disk in the way and supporting the disk.

605,679. Mounting for Electric Motors. Emil B. W. Reichel and Friedrich W. V. Stein, Berlin, Germany. Application filed January 27, 1898.

The motor-supporting truck has a spring carriage supported upon a relatively stationary part, two motors respectively disposed upon either side thereof, a supporting rod mounted upon the spring carriage, non-rigid connections uniting the supporting rod and motors approximately in the planes of the motors' centers of gravity, and a supplemental or secondary connecting part uniting the motors.



NO. 605,525.

605,688. Selector Signaling System. Thomas C. Drake, Malta, Ohio. Application filed September 17, 1807.

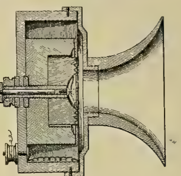
The combination is claimed in a selector system of a line circuit connecting a series of step-by-step and restoring mechanisms at a series of stations respectively, means for moving the series of step-by-step mechanisms to a predetermined position by an intermittent current, and means for operating the series of restoring mechanisms to reset the series of step by step mechanisms to normal on passing a current of greater strength than the intermittent current, the stepping and restoring mechanisms comprising electromagnets, connected in the line circuit whereby the diminished current may operate the ratchet wheel, lever and pawls to rotate the contact disk, and the normal current may operate the bifurcated lever to disengage the pawls respectively, the contact disk and contact screw to close a signaling circuit at a predetermined position of rotation of the series of mechanisms, and the segment gear to return the ratchet wheel and contact-disk to normal position on operating the restoring mechanism to reset the system.

605,695. Secondary Battery. Camille Brault, Paris, France. Application filed December 28, 1896. Patented in France August 14, 1895; in Belgium, January 10, 1896; in England, January 10, 1896, and in Switzerland, January 10, 1896.

One claim is given: In an electric accumulator, or storage battery, the combination with a body of active material of an inclosing fabric of asbestos, an outer covering or inclosure of perforated neutral material and cross rods, or bars, lying in openings in the active material, their ends being connected to the neutral plates by a solvent of the material of which said plates are composed.

605,714. Electric Arc Lamp. Daniel Higham, Boston, Mass. Application filed October 26, 1897.

The method is described of preventing excessive variations in consumption of two or more sets of electrodes connected in series and supplied from a direct current constant-potential source, the mode consisting of extinguishing the current by opening the circuit, then bringing the points of the two or more sets of electrodes to contact, to re-establish the current, and then separating the points of the two or more sets of electrodes an approximately equal distance apart.



NO. 605,575

605,741. Strain Insulator. Louis McCarthy, Boston, Mass. Application filed January 18, 1898.

A strain insulator comprising metallic portions separated from each other by interposed insulating material, a coupling member connected with a projecting part of one of the metallic portions outside of the insulating material by a swivel joint, and a connector having an adjustable screw-threaded union with the coupling member.

605,765. Apparatus for Supplying or Measuring Currents of Electricity. William D. Watson and Thomas Humphreys, Rochdale, England. Application filed December 28, 1897.

Mechanism for supplying and measuring electricity, consisting of primary clockwork, auxiliary clockwork, a governing lever actuated by the primary clockwork and controlling the escapement of the auxiliary clockwork, in combination with a cut-out device actuated by the auxiliary clockwork, and a device (controlled by the strength of the current used) whereby the governing lever remains inactive when no current is being used and allows the escapement to work quickly or slowly according as a greater or less amount of current is being used.

605,798. Electric Railway Signal. Charles L. Renrew, East Windsor, Conn. Application filed March 2, 1897.

A circuit breaker comprising a movable member, two conducting surfaces on the movable member insulated from each other, a non-conducting surface adjacent each conducting surface and out of line with each other, brushes bearing on each of the conducting surfaces out of the path of the non-conducting surface, and brushes bearing on the conducting surfaces and in the path of the non-conducting surfaces.

605,814. Electric-railway System. Henry A. Chase, Boston, Mass. Application filed February 7, 1891.

An electric-railway system, comprehending the following instrumentalities, is described: A conduit having a slot chamber; a conductor and guide having conducting and guiding surfaces located in the slot chamber and in line vertically with the slot of the slot chamber, independent tie-bars to connect the surfaces at intervals, and insulated arms to support the tie-bars, and a trolley frame, and a trolley made as a wheel, free to roll on the conductor.

605,824. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed December 14, 1897.

The combination is claimed of a car or vehicle, one or more electric motors to propel the car or vehicle, a speed controller for varying the speed of the motors, an air-brake apparatus for arresting the momentum of the car or vehicle, a pneumatic device for operating the controller under a pressure in excess of that necessary for the air brake, a common source of air supply, and means to vary the pressure of the air supply whereby the motors are cut out of operation as propelling motors when the air brake is applied.

605,832. Telephone Transmitter. William E. Sundberg, Worcester, Mass. Application filed September 28, 1897.

The claim is given: In a telephone transmitter, the combination of a casing having a mouthpiece, a metallic diaphragm, a plurality of screws having springs adjustably coiled thereon for holding the diaphragm in place, a contact plate carried by said diaphragm, a diaphragm, a contact plate secured thereon, a central adjusting screw having nuts for regulating the distance between said contact plates, a body of powdered carbon confined between the contact plates, and a felt washer secured on the contact plate in position to confine the body of powdered carbon, and to engage an inclined or chamfered edge on the contact plate.

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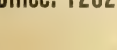

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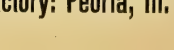

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Highest Development in Mechanical and Electrical Design.

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10 CENTS
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Western Electrician Moonlight Schedule
FOR 1898.
Every Lighting man should have one.

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Combination "Hot Blast" Blow Torch

(FOR GASOLINE.)

(PATENTED.)

New and Powerful Generator,

Three useful tools in one, viz.: Paint burner, plumbers' and electricians' torch and soldering-iron heater. Soldering-iron attachment is a most valuable feature. Generates blue flame 1,500° Fahrenheit. Will not blow out.

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No. 3397

Be On Time.

DO NOT LET

Jack Frost Stop Your Cars!

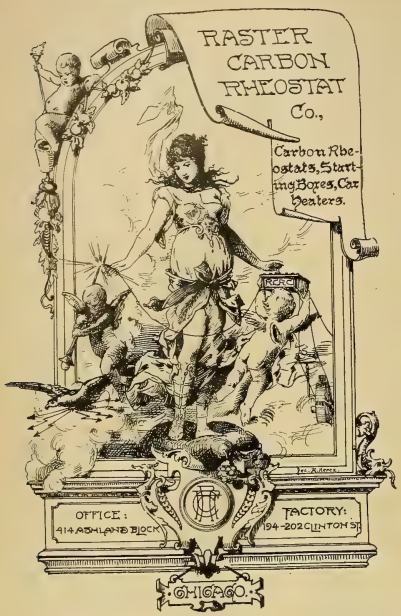
No. 3397.

This is the time of year when sleet gathers on the trolley wire. Sleet may not interfere with the operation of your cars or you may have means of clearing the wire.

We have a way to clear the wire of sleet by means of a **SLEET WHEEL.** This wheel is No. 3397 in our catalogue and the list price is $1.75 each. The design is a development resulting from experiments with a number of **SLEET WHEELS.** It will remove the sleet from the line without damaging any part of it and does not catch in an ear, frog or crossing.

If this interests you we would like to receive your order for one or more sleet wheels and would be pleased to quote you prices.

WESTERN ELECTRIC COMPANY,
CHICAGO. NEW YORK.



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FOR ALL PURPOSES.

Cannot burn out when overloaded.

Allow the selection of larger cross sections.

The only resistances not subjected to induction currents, and therefore the only practical instruments, excepting lampboard rheostats, for tests with alternating dynamos.

Retain an almost equal resistance whether hot or cold. In other words, not subjected to any outside influences whatsoever.

Starting boxes safely permit a continuous current of two minutes and more, and are tested with an overload of 25 per cent.

Inquiries, investigations and severest tests invited.

Send for descriptive circular and price lists.

Raster Carbon Rheostat Co.,

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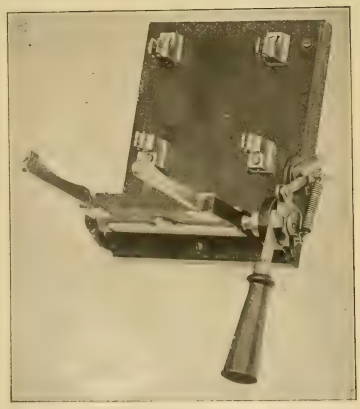
A Word to the Wise.



ANY VOLTAGE.

Extract from the Rules and Requirements of the National Board of Fire Underwriters.

SWITCHES:

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SEC. F. Must, for constant potential systems, have a firm and secure contact; must **make and break** readily, and not **stop** when motion has once been imparted by the handle.

We are the Only Switch Makers Who Fully Comply with the Above Rules.

Hope Electric Appliance Co.,

Providence, R. I.

New Catalogue Sent Upon Application.

AD STUDIO
COMMERCIAL ELECTRICAL SUPPLY CO. ST. LOUIS

A "Candle" may be a "Candle"—
and all that—
But some are made of beeswax,
and some are made of fat!

The above is merely a homely way of telling you that some arc lamps are a great deal better than others. Following are some most excellent reasons why the Jandus Arc Lamp is the best. These reasons are quoted bodily from the report of the Franklin Institute awarding to Wm. Jandus, patentee of the Jandus Enclosed Arc Lamp, the John Scott medal:

"The practical advantages of this lamp are:

"First.—That it can be used singly between mains of any ordinary direct incandescent circuit with comparatively little waste of energy.

"Second.—That the life of the carbons being so long, the lamp requires trimming only at long intervals; after certainly not less than 150 hours, thus showing a great economy in labor and carbons, this being about twenty times the life of a carbon in arc lamps now generally in use.

"Third.—The construction of the lamp is of an extremely simple character, with no complication of parts and with little liability to get out of order.

"In view of these facts, the Franklin Institute recommends the award of the John Scott Legacy Premium and Medal to William Jandus for his improved arc lamp adapted to incandescent circuits.

"Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, May 1, 1895.

"(Signed) Jos. M. Wilson, President.
Wm. H. Wahl, Secretary.
"(Countersigned) Samuel Sartain, Chairman."

THE

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150 Hour Enclosed
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Inside Service.

Constant Potential,
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Short Types.

Mechanically and electrically without an equal.

Used by more than 150 Central Stations.

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The standard "Jandus" 150 hour arc lamp is the same as that formerly sold as the "Manhattan." The Jandus Electric Co. is the **sole owner** of the patents of William Jandus and the **sole manufacturer** of the 150 hour enclosed arc lamps made under these patents and heretofore sold as "Manhattan."

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Address all inquiries regarding the "Jandus" (formerly known as the "Manhattan") 150 hour enclosed arc lamp, to our Cleveland or Chicago office. Catalog on

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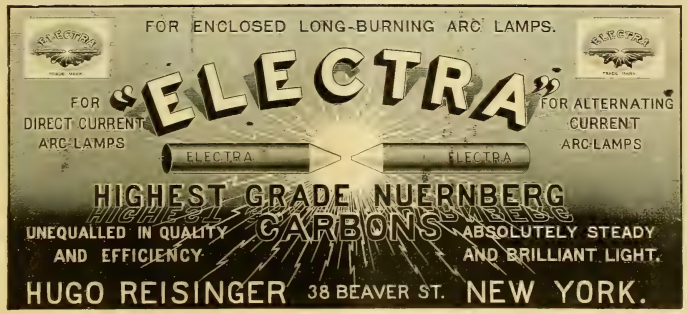

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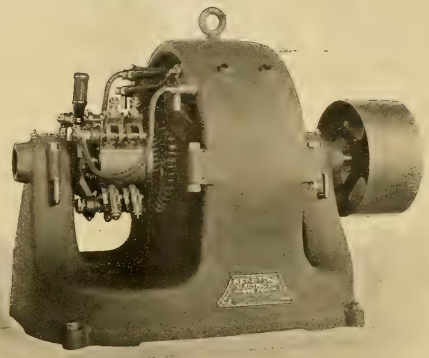

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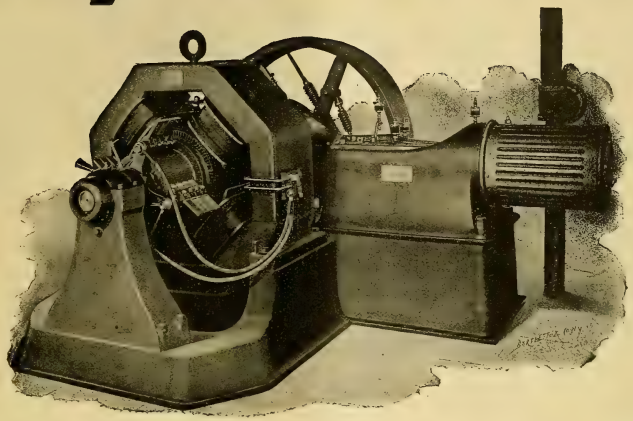

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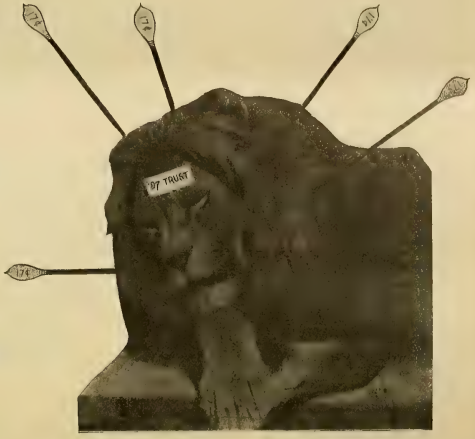

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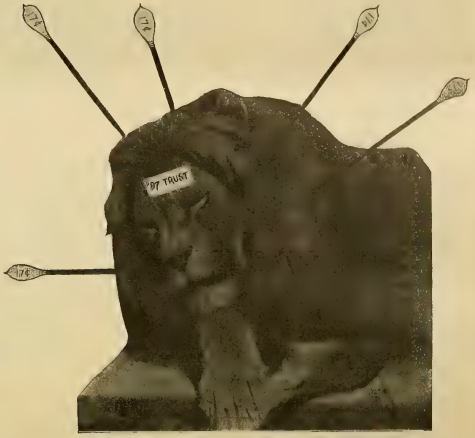

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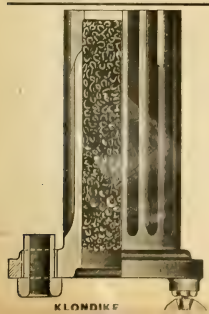
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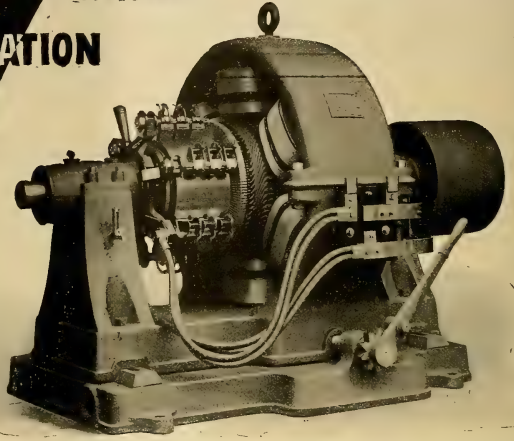

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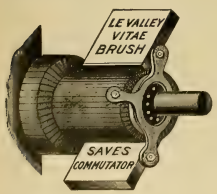

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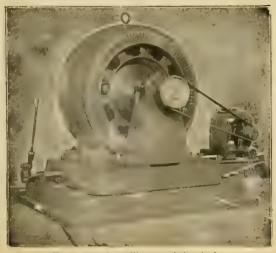

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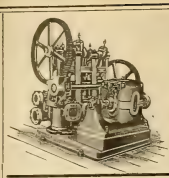

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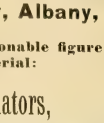

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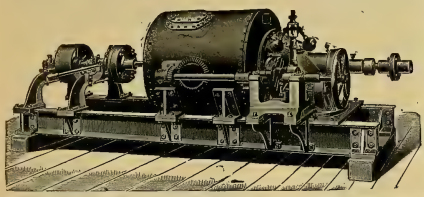

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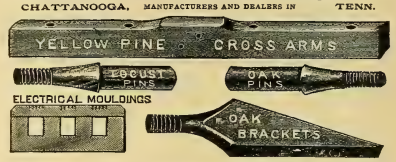

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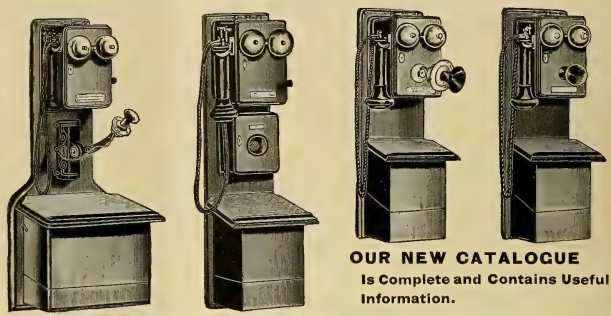

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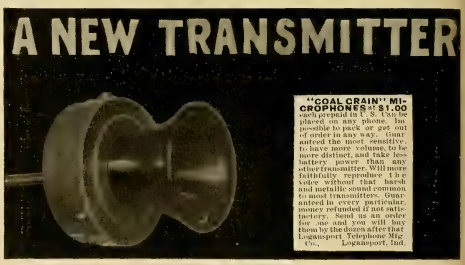

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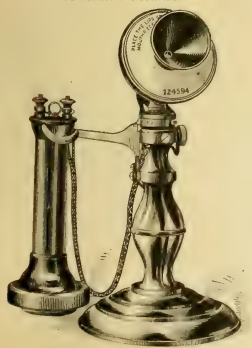

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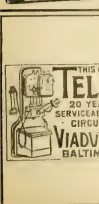

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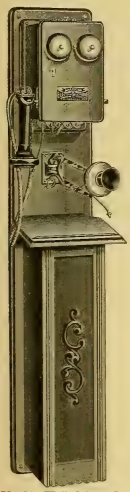

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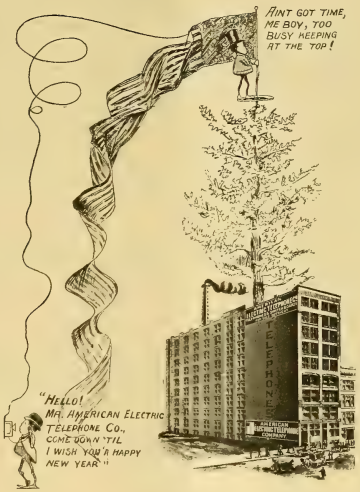

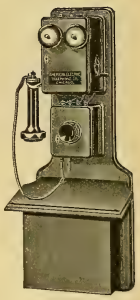

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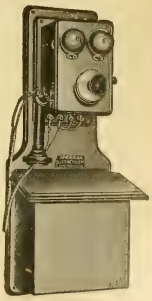

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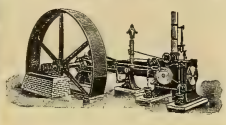

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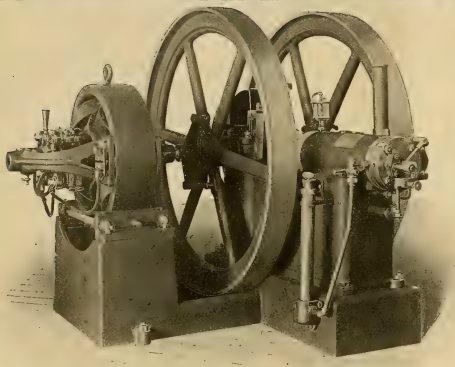

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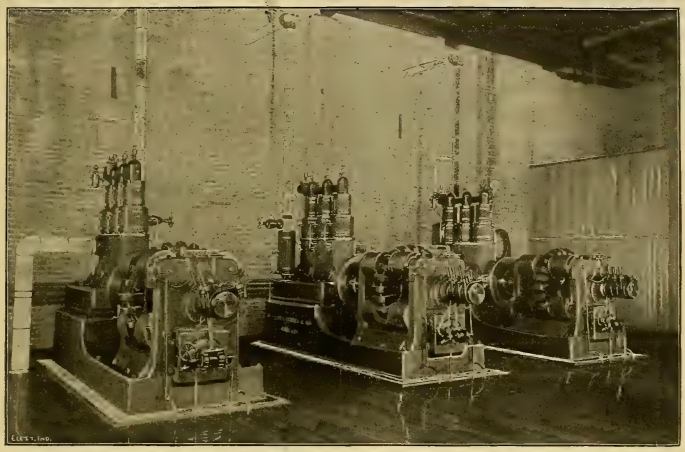

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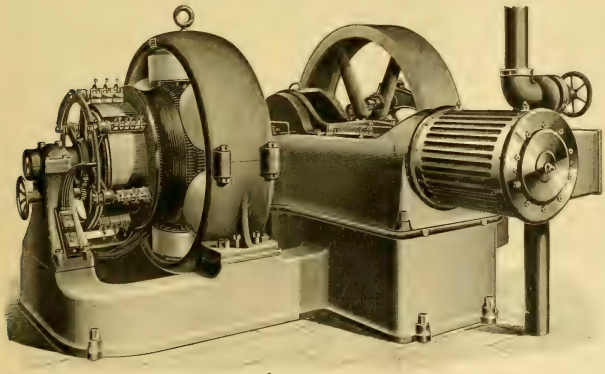

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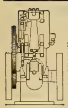

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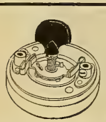

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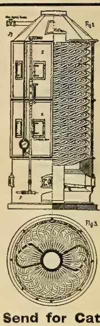

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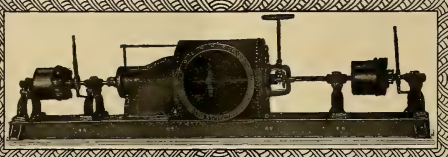

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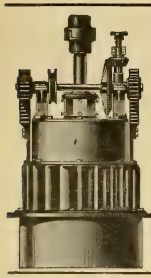

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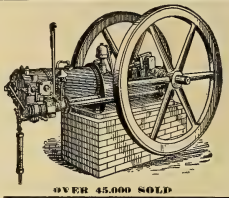

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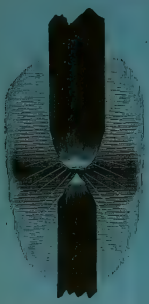

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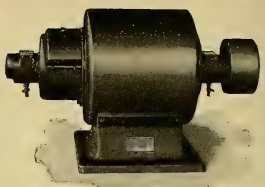

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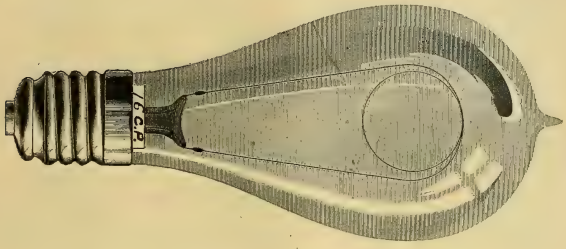

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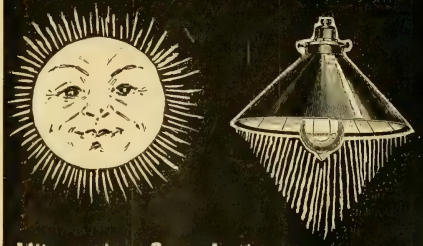

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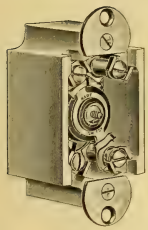

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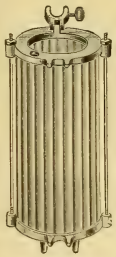

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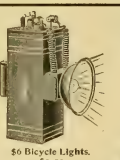

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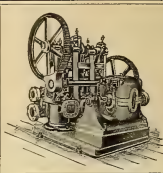

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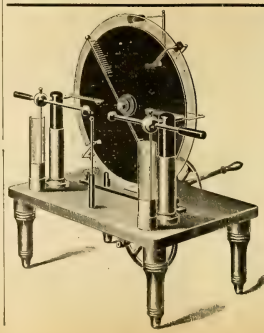

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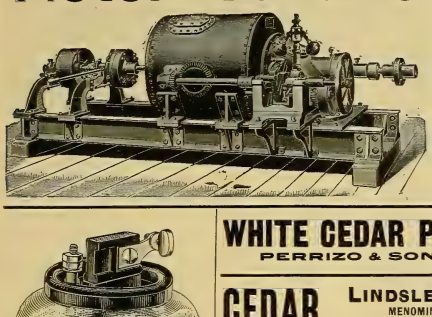

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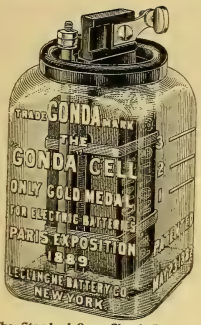

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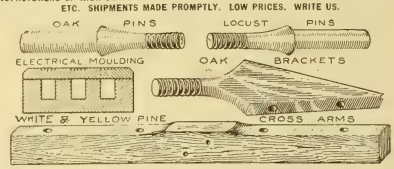

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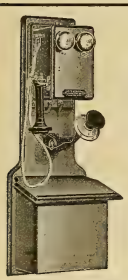

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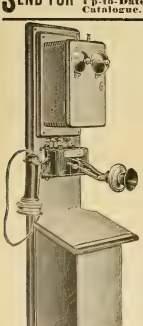

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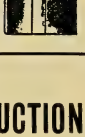

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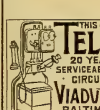

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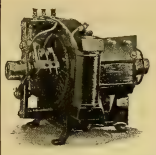

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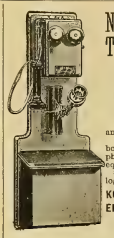

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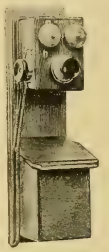

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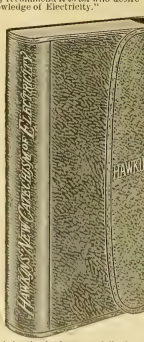

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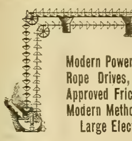

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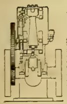

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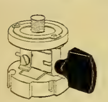

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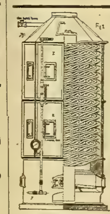

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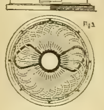

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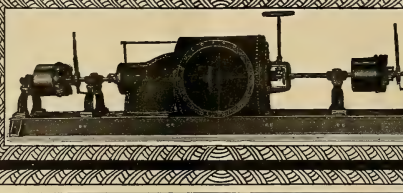

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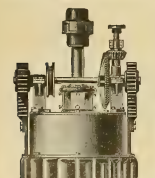

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Samson Cordage Wks.
Batteries and Jars.
Ansonia Electrical Co.
Burnley Batt. & Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
Elec. Gas Lighting Co.
Gordon-Burnham Battery Co
Leclanche Battery Co., The
National Carbon Co.
Partrick, Carter & Wilkins.
Peru Elec. Mfg. Co.
Reliable Elec. Supply Co.
Roche, William.
Western Electric Co.
Bells.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Huebel & Manger.
Partrick, Carter & Wilkins
Proctor-Raymond Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.
Belting.
Link Belt Machinery Co.
L. P. & D. Transmitter Co.
Main Belting Co.
Peerless Rubber Mfg. Co.
Shultz Belting Co.
Boilers.
Abendroth & Roth Mfg Co.
Cleanbrook Steam Boiler Co.
Books, Electrical.
Electrician Publishing Co.
Brass Founders and Finishers—Metal Patterns
Moser & Wilson
Brushes.
Central Electric Co.
Commercial El. Supply Co.
Crown Woven W. Brush Co.
Holmes Fibre-Graphite Co.
K. & W. Company.
Ohio Elec. Specialty Mfg. Co.
Partridge Carbon Co.
Burglar Alarms.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Huebel & Manger
Partrick, Carter & Wilkins.
Cables (See Insulated Wires.)
Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
General Electric Co.
Moore, Alfred F.
New York Ins. Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Carbons, Points & Plates.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
Gen'l Inc. Arc Light Co.
National Carbon Co.
Partridge Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Compound.
Boiler Expurgator Co.
Central Electric Co.
California Asphalt Co.
Dearborn Drug & Chem. Wks
Electric Appliance Co.
K. & W. Company.
Mass. Chemical Co.
McLennan & Co., K.
Ohio Elec. Specialty Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.
Conduit and Conduits.
Armorite Interior Cond. Co.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Construction & Repairs.
Chicago Edison Co.
Crouse-Hinds Elec. Co.
Electrical Exchange, The.
Elliott, W. H. Elec. Co.
Ft. Wayne Elec. Corporation.
Hodge, Walsh & Loring.
Keystone Electric Co.
McRae, A. L.
Morrell Electric Works.
Roth Bros. & Co.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Electric Mfg. Co.
Western Electric Co.
Contractors and Electric Light Plants.
Bain, Foree.
Broughton, H. P.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Keystone Electric Co.
McRae, A. L.
Northern Electl. Mfg. Co.
Peoples Electric Co.
Roth Bros. & Co.
Sargent & Lundy.
Siemens & Halske Elec. Co.
Triumph Electric Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec & Mfg Co.
Conveyors.
Link-Belt Machinery Co.
Copper.
Besly & Co., Chas. H.
Mansfield Temp. Copper Co.
Mitchell Temp. Copper Co.
Copper Wires.
American Electrical Works.
Besly & Co., Chas H.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons, Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Cordage.
Central Electric Co.
Samson Cordage Wks.
Correspondence Schools.
Int. Correspond. Schools.
Crookes' Tubes.
Central Electric Co.
Commercial El. Supply Co.
Edison Lamp Dept.
Swett & Lewis Co.
Cross-Arms, Pins and Brackets.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial El. Supply Co.
Electric Appliance Co.
Electric Ry. Equipment Co.
Farr Tel. & Cons. Sup. Co.
Locke, Fred. M.
Cut-Outs and Switches.
Bossert Elec. Const. Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Crouse-Hinds Elec. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Hill, W. S. Electric Co.
K. & W. Company
Paiste Co., H. T.
Peoples Electric Co.
Peru Elec. Mfg. Co.
Reliable Elec. Supply Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Dynamos.
American Engine Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co
Keystone Electric Co.
Northern Electl. Mfg. Co.
Nott & Co., A. D.
Roth Bros. & Co.
Sargent & Lundy.
Siemens & Halske Elec. Co.
Triumph Electric Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warner, Wm. F.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wright, Wm.
Economizers, Fuel.
Fuel Economizer Co.
Electric Heat'g App's.
Central Electric Co.
Electric Meters.
American El. Meter Co.
Zamel Arc Light Meter Co.
Electric Railways.
General Electric Co.
Westinghouse El. & Mfg. Co.
Electrical and Mechanical Engineers.
American Elec. Eng. Assn.
Bain, Foree.
Broughton, H. P.
McRae, A. L.
Sargent & Lundy.
Electrical Instruments.
Central Electric Co.
Commercial El. Supply Co.
Crouse-Hinds Elec. Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
General Electric Co.
Hill, W. S. Electric Co.
Keystone El. Instrument Co.
Paiste Co., H. T.
Queen & Co.
Reliable Elec. Supply Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Weston Electrical Inst. Co.
Electrical Specialties.
Central Electric Co.
Commercial El. Supply Co.
Crouse-Hinds Elec. Co.
Hill, W. S. Electric Co.
Ohio Elec Specialty Mfg. Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Vought, M. I.
Electro-Magnets.
Varley Duplex-Magnet Co.
Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.
Hobart Elec. Mfg. Co.
Nott & Co., A. D.
Roth Bros. & Co.
Engines, Gas.
Foos Gas Engine Co.
Otto Gas Engine Wks.
Prouty Co. The.
Engines, Steam.
American Engine Co.
Ball Engine Co.
Filer & Stowell Co.
Fan Outfits.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Emerson El. Mfg. Co.
Farr Tel. & Cons. Sup. Co.
General Electric Co.
Roth Bros. & Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
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Davis & Son, I. B.
Fibre.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Kartavert Mfg. Co.
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Barnett Co., G. & H.
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Central Electric Co.
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Stow Mfg. Co.
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D. & W. Fuse Co.
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Commercial El. Supply Co.
Electric Appliance Co.
Shawmut Fuse Wire Co.
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Central Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co.
Gears.
Besly & Co., Chas. H.
Central Electric Co.
Link-Belt Machinery Co.
General Elec. Supplies.
Ansonia Electrical Co.
Besly & Co., Chas. H.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Crouse-Hinds Elec. Co.
Electric Appliance Co.
Electric Ry. Equipment Co.
General Electric Co.
Hodge, Walsh & Loring.
Hill, W. S. Electric Co.
K. & W. Company.
Meysenburg & Badt.
Paiste Co., H. T.
Partrick, Carter & Wilkins.
Peoples Electric Co.
Peru Elec. Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.
Globes and Electrical Glassware.
Central Electric Co.
Commercial El. Supply Co.
Wheeler Reflector Co.
Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.
Graphite Specialties.
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Central Electric Co.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.
Hanger Boards.
K. & W. Company.
Induction Coils.
Central Electric Co.
Queen & Co.
Insulators and Insulating Materials.
Ansonia Electrical Co.
Brixey, W. R.
Bryant Electric Co.
California Asphalt Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Crouse-Hinds Elec. Co.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Kartavert Mfg. Co.
K. & W. Company.
Locke, Fred. M.
Mass. Chemical Co.
Mica Insulator Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Underground C. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co
Montauk Multiph. Cable Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
Junction Boxes.
Bossert Elec. Const. Co.
Lamp Adjusters.
Farles Mfg. Co.
Vought, M. I.
White Co., O. C.
Lamps, Alternating.
Puritan Electric Co.
Lamp Guards.
Wagor, P. R. & Co.
Lamps, Incandescent.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Edison Lamp Dept.
Electric Appliance Co.
General Electric Co.,
K. & W. Company.
Lynn Incandescent Lp. Co.
Reliable Elec. Supply Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Wormley, Jas. C. & Co.
Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.
Magnet Wire.
(See Insulated Wires.)
Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Valle
Mica.
Central Electric Co.
Commercial El. Supply Co.
Munsell & Co., Eugene.
Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co
Westinghouse El. & Mfg. Co
Motors.
American Engine Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation
General Electric Co.
Hobart Elec. Mfg. Co.
Keystone Electric Co.
Northern Electl. Mfg. Co.
Peoples Electric Co.
Roth Bros. & Co.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wright, Wm.
Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co
Robertson & Sons, Jas. L.
Paints.
California Asphalt Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.
Platinum.
Baker & Co.
Poles.
Berthold & Jennings.
Central Mfg. Co.
Electric Ry. Equipment Co.
Lindsley Bros.
National Tube Works Co.
Perrizo & Sons.
Point Marion Mfg. Co.
Stone Lumber Co.
Torrey Cedar Co.
Porcelain.
Bryant Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.
Radiators.
Shadowless Radiator Mfg. Co.
Refiners.
Goldsmith Bros
Swarts Metal Refining Co.
Reflectors.
Amer. Reflector & Ltg. Co.
Shadowless Radiator Mfg. Co.
Re-Winding—Repairs.
Central Electric Co.
Chicago Edison Co.
Electrical Exchange, The.
Elliott, W. H. Elec. Co.
Hodge, Walsh & Loring.
Morrell Electric Works.
Rheostats.
American Rheostat Co.
Central Electric Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Iron Clad Rheostat Co.
Ohio Elec. Specialty Mfg. Co.
Raster Carbon Rheostat Co
Westinghouse El. & Mfg. Co
Second-Hand Machin'y.
Cornman Co.
Electrical Exchange, The.
Elliott, W. H. Elec. Co.
Hodge, Walsh & Loring.
Seyfert's Sons, L. F.
Wright, Wm.
Shades.
Amer Reflector & Ltg. Co.
Central Electric Co.
Spark Arresters.
K. & W. Company.
Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Partrick, Carter & Wilkins.
Western Electric Co.
Speed Indicators.
Besly & Co., Chas. H.
Central Electric Co.
Keystone El. Instrument Co.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.
Steel Boxes.
Bossert Elec. Const. Co.
Steel Pipe.
National Tube Works Co.
Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Street Cars.
Stephenson Co., John.
Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Central Electric Co.
Commercial El. Supply Co
Farr Tel. & Cons. Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Lockwood T. & T. Co. of Am.
Logansport Tel. Mfg. Co.
Mo. Tel Mfg. Co.
Northwest Engineering Co.
N. W. Tel. Mfg. Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Stromberg-Carlson Tl. M. Co.
Taber & Mayer.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Cons. Co.
Transformers.
Central Electric Co.
Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Roth Bros. & Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Trolley Cord.
Central Electric Co.
Samson Cordage Wks.
Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.
Turbine & Water Wheels.
Am. Impulse Wheel Co.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Valle.
Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C Co
Washburn & Moen Mfg. Co.
Western Electric Co.
X Ray Outfits.
Central Electric Co.
Commercial El. Supply Co.
Edison Lamp Dept.
Queen & Co.
Swett & Lewis Co.

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LAMPS

MOST IMPROVED TYPE FOR DIRECT CURRENT CIRCUITS.
HIGHEST DEVELOPMENT IN ELECTRICAL DESIGN.

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ELIZABETHPORT, N. J.

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HART LOCK FLUSH SWITCH.

Removable key. The lock attachment can also be applied to our Gang Plates and **Standard** Switches.

Lock Switches are Desirable in Many Cases.

See our Illustrated Catalogue for further information.

The Hart & Hegeman Mfg. Co.,
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On receipt of
10 CENTS
..... We will send you a
Western Electrician
Moonlight Schedule
FOR 1898.
Every Lighting man should have one.

ELECTRICIAN PUBLISHING CO.,
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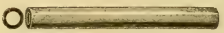


IRON ARMORED, BRASS ARMORED AND PLAIN CONDUIT.

Conduit Fittings and Tools for Conduit Work.

A Large Supply

Carried in Stock.

WESTERN ELECTRIC CO.,
CHICAGO. NEW YORK.

New Transformer Lines

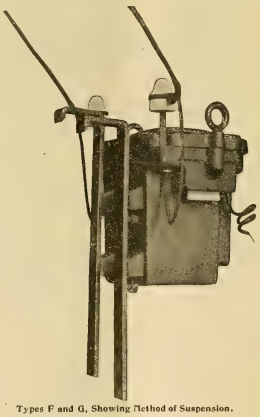
FOR 1898.

The Type G Extra High Efficiency.
The Type F High Efficiency.

Types F and G, without Attached Cut-Outs.

THE TYPE G.

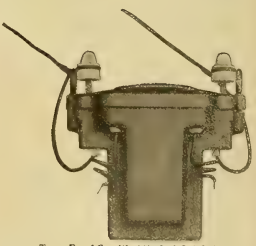
This line has been developed to meet the call for a better transformer, electrically and mechanically considered, for all day station service, than the market afforded. In this line "all day efficiencies" have been placed at a point competitors will find trouble in equaling for some time to come. In all considerations it is the "fin de siecle" transformer. Write for the Type G bulletin describing it in detail.



Types F and G, Showing Method of Suspension.

New Methods of Construction throughout. Improved Design from all Points of View.

Two Forms up to 5 K.W. Sizes, with and without Attached Cut-Outs.



Types F and G, with Attached Cut-Outs.

THE TYPE F.

The Type F displaces the well-known Type D, which has been this company's standard the last two years. It is the same transformer as the Type D in efficiency, core loss and regulation, and the same as the Type G in all mechanical features. Write for the Type F bulletin.

Wagner Electric Manufacturing Co.,

New York, 203 Havemeyer Building, A. H. Mustard, Agt.
Boston, 620 Atlantic Avenue, Henry M. Nay, Agt.
Philadelphia, 1000 Betz Building, John Mustard, Agt.
Chicago, 1323-1324 Marquette Building, J. Holt Gates, Agt.
San Francisco, 409 Market St., California Elec. Works, Agt.

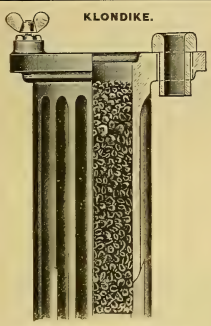
General Offices and Factory,
St. Louis, U. S. A.

Toronto, Canada, W. A. Johnson Electric Co., Agt.
Central and Western States, Central Elec. Co., Chicago, Agt.
Yokohama, Japan, Bagnall & Hilles, Agts.
London, England, Laing, Wharton & Down, Agts.

GOOD CARBONS MEAN LESS COST FOR CURRENT. Therefore, wherever a highly efficient service is desired, it is of the utmost importance to use the best Carbons obtainable.

"All the excellence in dynamos and arc lamps counts for but little, when poor Carbons are used in the lamps."

NOTICE.—The "Electra" Highest Grade Nuernberg Carbons are, as heretofore, manufactured by the world-renowned firm of C. Conradty of Nuernberg. See that every package of my Carbons bears the label with my trade-mark "Electra," and thus beware of imitations.
To protect the interest of purchasers of my Carbons, I am determined to proceed against infringers of my "Electra" trade-mark.



"KLONDIKE." No. 2 CELL.

(Patent Applied for.)

A GUARANTEE SHOULD MEAN SOMETHING; READ THIS:

"We will return a new cell, complete, in any case where corrosion is complained of in either the National No. 2 or the 'Klondike.'"

NATIONAL CARBON COMPANY,

600 Highland Ave., CLEVELAND, O.

IT IS FOLLY TO INSTALL GOOD MACHINERY

TO SUPPLY CURRENT TO POOR LAMPS, THE LAMP BEING **END, AIM** AND **TEST** OF THE LIGHTING SYSTEM. IF, HOWEVER, YOU ARE LOOKING FOR QUALITY IN YOUR **INCANDESCENT LAMPS** TRY THE

"HARDY."

SUSTAINED CANDLE POWER IS ITS STRONG POINT.

TO PROVE IT, WE WILL SEND YOU BY EXPRESS, CHARGES PREPAID, ONE DOZEN 16 C. P.,.3 or 3½ WATT LAMPS, ANY BASE, ANY VOLTAGE, FROM 45v. TO 125v. FOR $2.16; OR 200v. TO 250v. FOR $3.86.

AGENTS WANTED. CORRESPONDENCE SOLICITED.

THE K. & W. COMPANY,

—MANUFACTURERS OF—

HARDY INCANDESCENT LAMPS, HANGER BOARDS, COMPOSITE DYNAMO BRUSHES, SPARK ARRESTERS, AND COMMUTATOR COMPOUND.

PITTSFIELD, MASSACHUSETTS.

WESTERN REPRESENTATIVES: MEYSENBURG & BADT, 1504 MONADNOCK BLOCK, CHICAGO.

A NEW YEAR'S INCIDENT.

Special Dispatch—New York, January 1.—The many anxious friends and relatives of the passengers and crew on the little vessel "New Year '98," which, it will be remembered, has been a year overdue, and had been given up as lost owing to the terrible weather during its period of crossing, will be greatly relieved to know that this boat was sighted off Sandy Hook, New York, December 31, at 11:59 midnight. The bark is in a somewhat shattered condition, but Capt. McKinley reports that there was no material injury to the frame of the vessel and only its upper works were badly damaged, as shown in the illustration of the boat as it now lays on the beach. Now that the vessel is safe in port it will be called to mind that when it was first rumored that the "Ninety-Eight" was lost it was noised about that the owners had, before appointing its present master, hesitated over the appointment of Capt. McKinley. This hesitancy was due largely to the latter's pronounced belief as to the exact location of "Gold Island" in Trade Ocean, and the possible danger due to such uncertainty. A number of passengers, however, with some nautical training, who came over in the "New Year '98," are now convinced from personal observations of Gold Island, that this Island is literally "built on a rock" and has a foundation sufficient to support the "weight of the nation," so to speak. The owners of the "New Year '98" are therefore inclined to be much pleased with Capt. McKinley's work and many have assured him personally—on top of congratulations on his success with a dangerous task—that his present command will be secured for at least three more voyages and perhaps longer. The "New Year '98" will be entirely refitted before starting on the return voyage and will carry a large cargo of "Armorite" conduit.

Any child can see the point!

It's so simple!

ARMORITE INTERIOR CONDUIT CO.

PITTSBURG, PA., U.S.A.

A "Candle" may be a "Candle"—
and all that—
But some are made of beeswax,
and some are made of fat!

The above is merely a homely way of telling you that some arc lamps are a great deal better than others. Following are some most excellent reasons why the Jandus Arc Lamp is the best. These reasons are quoted bodily from the report of the Franklin Institute awarding to Wm. Jandus, patentee of the Jandus Enclosed Arc Lamp, the John Scott medal:

"The practical advantages of this lamp are:

"First.—That it can be used singly between mains of any ordinary direct incandescent circuit with comparatively little waste of energy.

"Second.—That the life of the carbons being so long, the lamp requires trimming only at long intervals; after certainly not less than 150 hours, thus showing a great economy in labor and carbons, this being about twenty times the life of a carbon in arc lamps now generally in use.

"Third.—The construction of the lamp is of an extremely simple character, with no complication of parts and with little liability to get out of order.

"In view of these facts, the Franklin Institute recommends the award of the John Scott Legacy Premium and Medal to William Jandus for his improved arc lamp adapted to incandescent circuits.

"Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, May 1, 1895.

"(Signed) Jos. M. Wilson, President.
Wm. H. Wahl, Secretary.
"(Countersigned) Samuel Sartain, Chairman."

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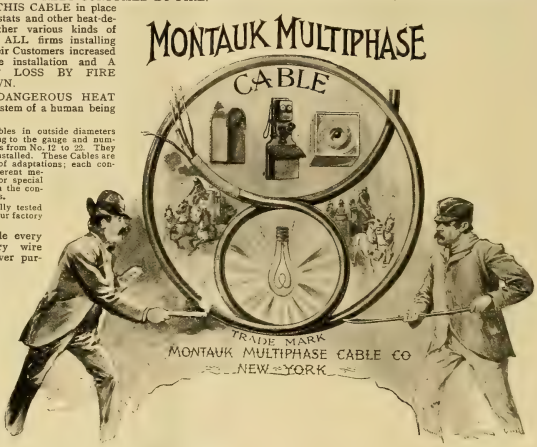

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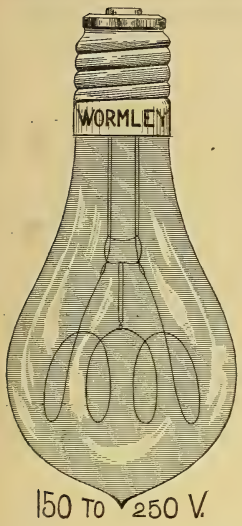

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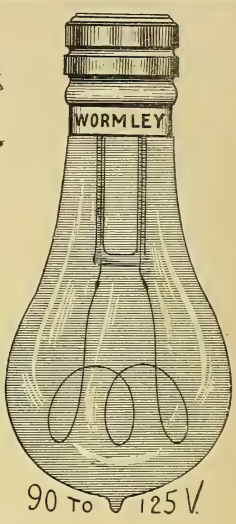

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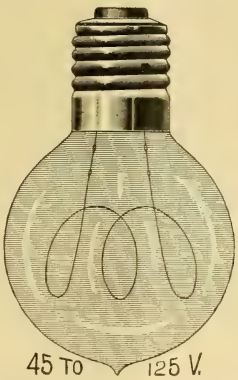

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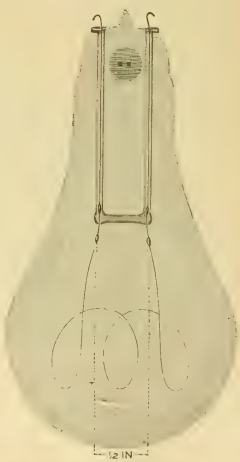

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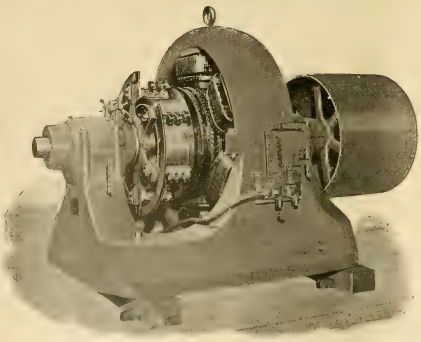

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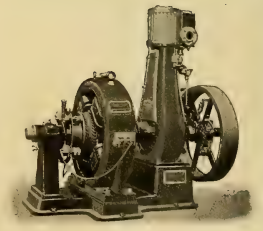

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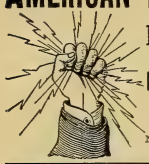

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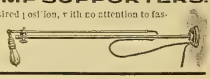

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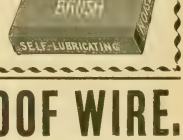

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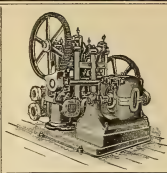

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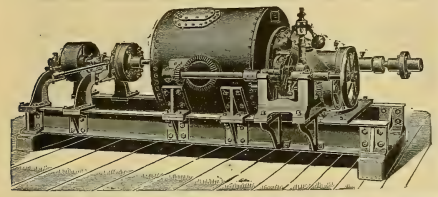

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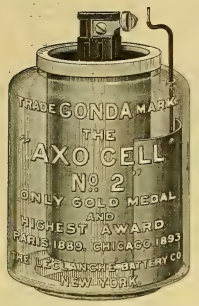

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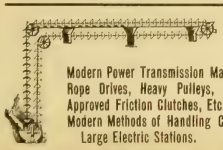

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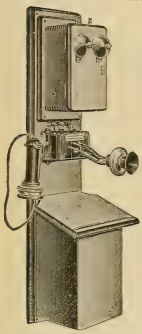

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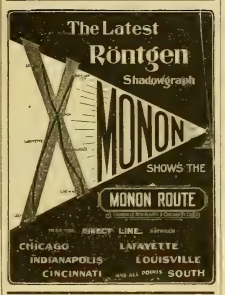

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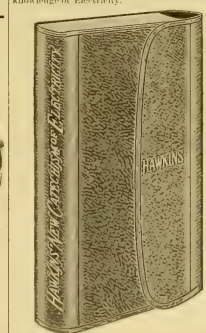

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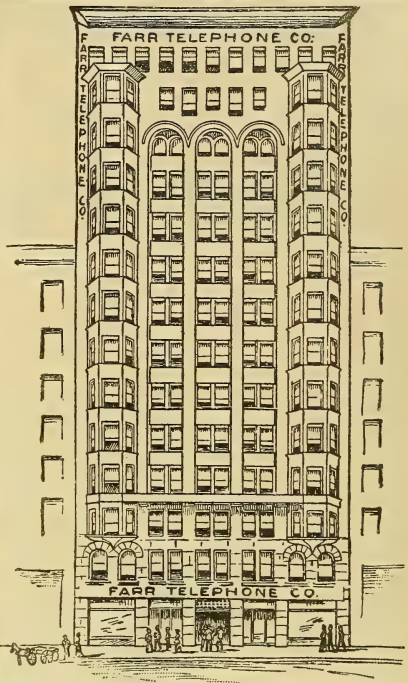

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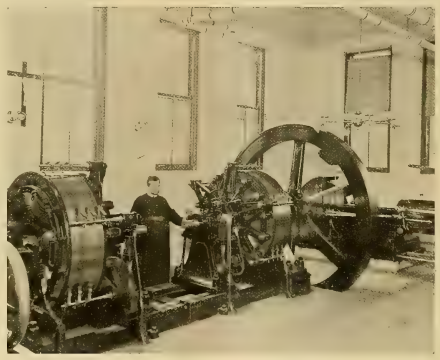

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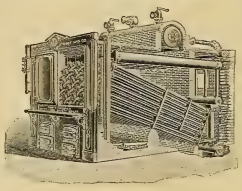

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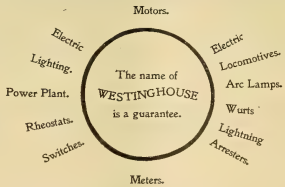

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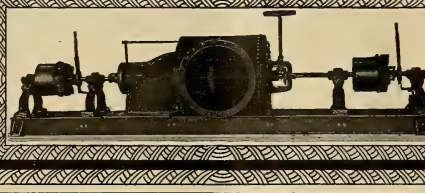

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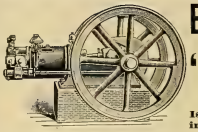

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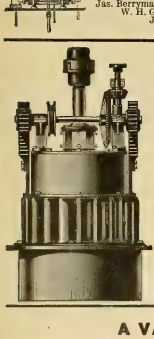

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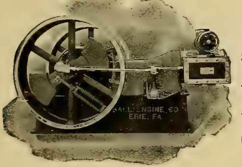

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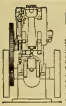

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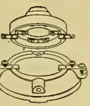

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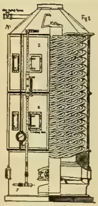

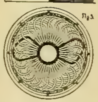

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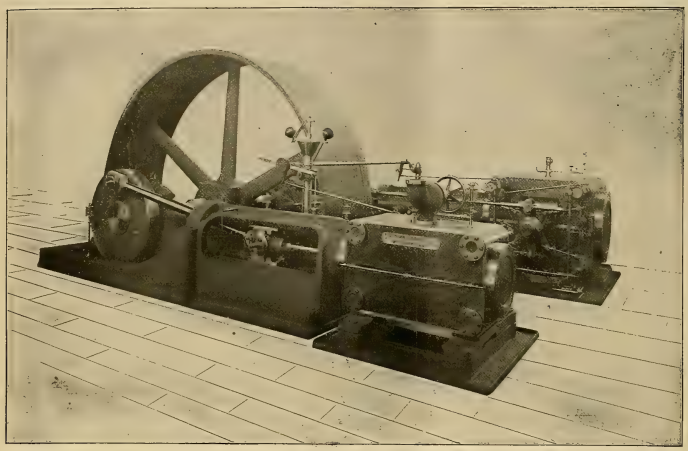

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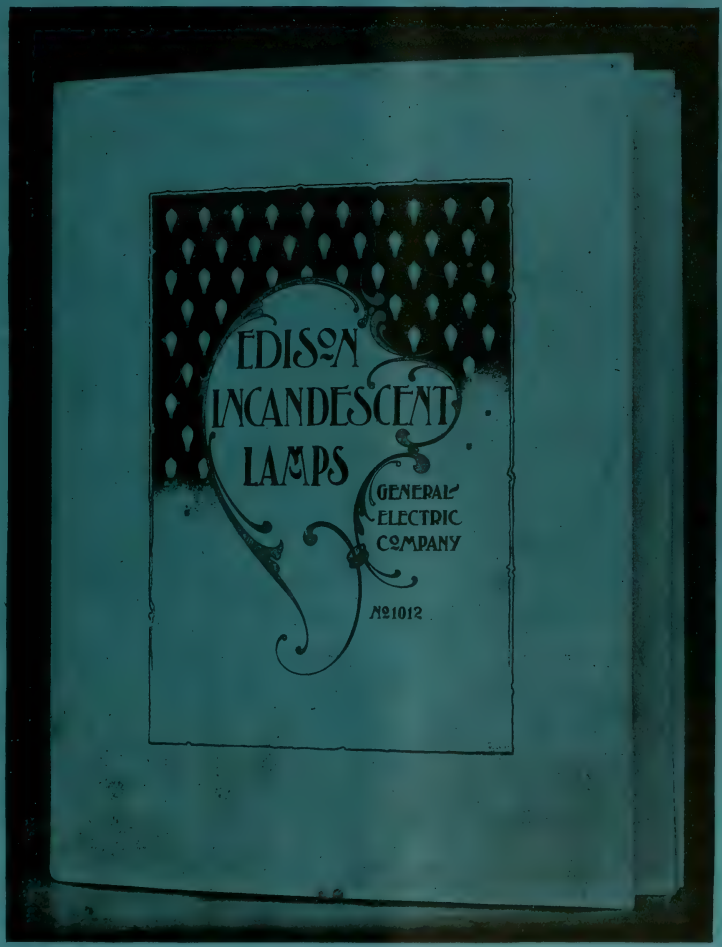

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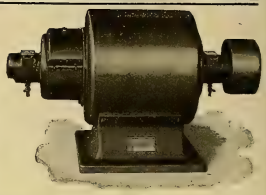

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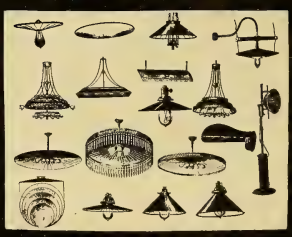

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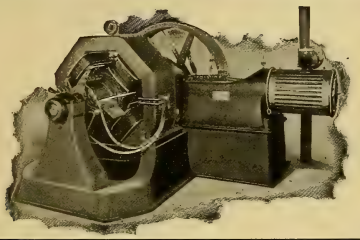

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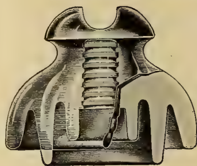

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General Electric Co.
Westinghouse El. & Mfg. Co.
Turbine & Water Wheels.
Am. Impulse Wheel Co.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.
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Western Electric Co.
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Edison Lamp Dept.
Queen & Co.
Swett & Lewis Co.

For Alphabetical Index of Advertisements See Page iii.

DIEHL FANS

FOR ALL CIRCUITS, EXCEPT ALTERNATING.

OUR CEILING FANS AND ELECTROLIERS ARE THE

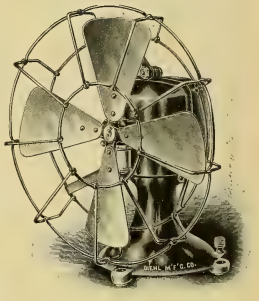
Recognized Standard

OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency

Of Any on the Market.



WRITE FOR CIRCULARS AND PRICES ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway. CHICAGO: 192-194 Van Buren St. BOSTON: 128-132 Essex St.

DIEHL MANUFACTURING CO.,

ELIZABETHPORT, N. J.

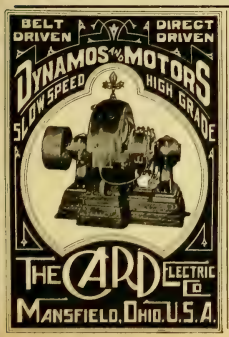
The S-W Arc Light Radiators.

BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.
Will give exclusive agency to responsible house in principal cities.

SHADOWLESS RADIATOR MFG. CO.,

FARIBAULT, MINN.



On receipt of

10 CENTS

.....We will send you a

Western Electrician Moonlight Schedule

FOR 1898.

Every Lighting man should have one.

ELECTRICIAN PUBLISHING CO.,

Suite 510 Marquette Bldg., CHICAGO

IRON ARMORED,
BRASS ARMORED AND
PLAIN CONDUIT.

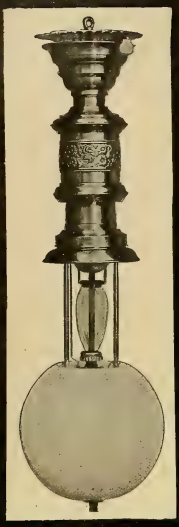
Conduit Fittings and Tools for Conduit Work.

A Large Supply

Carried in Stock.

WESTERN ELECTRIC COMPANY,

CHICAGO NEW YORK



JANDUS ELECTRIC CO.

CHICAGO
753 MONADNOCK

FACTORY AND MAIN OFFICE
CLEVELAND OHIO.

GENERAL AGENTS

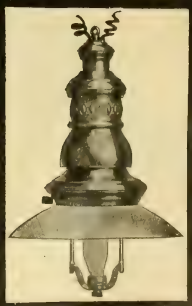
ELECTRICAL ENGINEERING CO. MINNEAPOLIS MINN.
INTER-MOUNTAIN ELECTRIC CO. SALT LAKE CITY UTAH
KEELYN AND SMITH MILWAUKEE WIS.
WOLFE ELECTRICAL CO. OMAHA NEB.

AGENCIES EVERYWHERE

THE "JANDUS"

150 HOUR ENCLOSED ARC LAMP

COVERS THE ENTIRE LIGHTING FIELD.

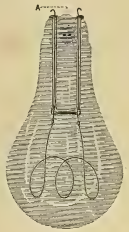


IN THE ABSENCE OF PERFECTION PROGRESS IS POSSIBLE.

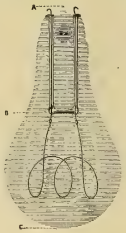
The most **Valuable Improvement** in Lamps during the last ten years is the **Shelby Patent** Insulated Leading-in Wires.

BUT SHELBY LAMPS ARE MADE BY US.

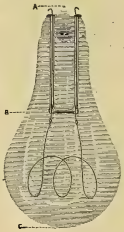
We do not depend on others for our carbons. **The Carbon and the Vacuum** of the lamp. We have a make the life



SPECIAL CARBON



HALF SIZE SHELBY LAMPS.



Made so the **Candle Power** remains constant for a much longer time than other lamps. Our lamps do not blacken.

In fact

SHELBY LAMPS ARE THE BEST ON EARTH.

The Shelby Electric Co.,

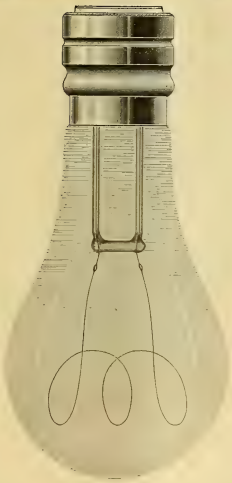
BOX 18, SHELBY, OHIO.

THE SHELBY LAMP.

Insulated Leading-in Wires.

Cannot Short-Circuit.

The Only Lamp for Damp Places.



16 C. P. 50 Watt Lamps.

Any Voltage to 125.

250 Volt Lamps,

Any efficiency from 3.2 to 4.5 Watts per C. P.

They cast no shadows. No tip to break.

The Shelby Electric Co.,

BOX 18, SHELBY, OHIO.

HAVE YOU SEEN

Our Constant-Current Series-Enclosed

We manufacture Arc Lamps for all circuits, and purchasers buying our open-arc lamps to suit their present dynamos can have them altered to enclosed in the future at a minimum cost.

Write for Circulars and Prices.

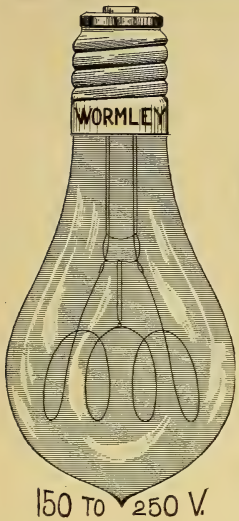
Write for Circulars and Prices.

ARC LAMP?

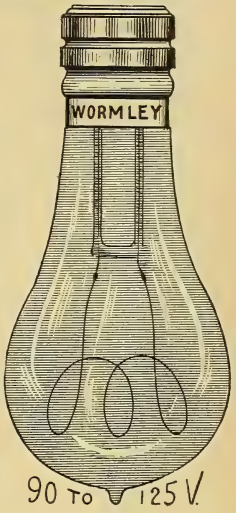
The Adams-Bagnall Electric Co.,

CLEVELAND.

AGENCIES: McGILL & EMERSON, 112 Monadnock Block, Chicago, Ill.
WESTERN ELECTRICAL SUPPLY Co, 10 and 12 N. Ninth St., St. Louis, Mo.
C. W. PHIPPS, 252 Havemeyer Bldg., New York, N. Y.



READ REPORT OF TEST BELOW MADE BY A MOST RELIABLE CONSUMER AND SAY, CAN WE FURNISH HIGH EFFICIENCY LAMPS WITH LIFE?



AN ABSOLUTELY FIRE PROOF HOTEL.

The VIRGINIA HOTEL.
RUSH & OHIO STREETS
CHICAGO.

January 18th. 1898

Jas. C. Wormley & Co.,
Marquette Bldg.,
Chicago.

Gentlemen:-

We have now finished test on the "Wormley" lamps which I took from your shipment of October 29th and, as per your request, give you copy of our record herewith:

Intial test Oct. 31st. '97.

Volts.	Av.C.P.	Av.Watts per lamp.	Av.Watts per C.P.
110	16	47-19/100	2-94/100

Average life 922 hours.

It is needless to say we are greatly pleased with your lamps.

Yours truly,

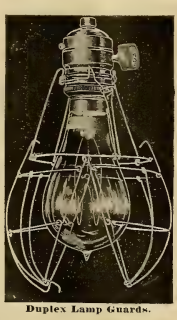
W. T. Kinman

Chief Engineer.

"BEST ON EARTH!"

Helios Arc Lamps.

Medbery Railway Material.



Duplex Lamp Guards.

Medbery Railway Material.

JUST A "FEW!"

(TRY FOR PRICES!)

COMMERCIAL ELECTRICAL SUPPLY CO.,

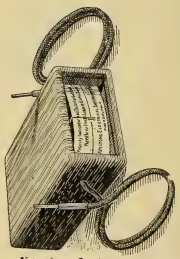
ST. LOUIS.

Helios Arc Lamps.

Medbery.

Medbery.

Keystone Instruments.



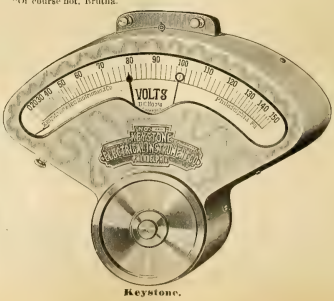
Keystone Instruments.

A VERY LITTLE STORY (with a very big moral!)

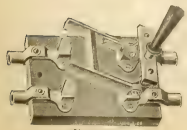
"Oh, Brutha, why does the 'Big Bird' hurt the 'Little Frog'?"

"Ah, Sista, don't you know? Because the Little Frog got in the Big Bird's way and croaked so the Big Bird had to eat up the Little Frog! and of course the Little Frog didn't like it."

"Of course not, Brutha."



Keystone.



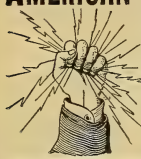
Keystone.

Keystone.

EUGENE F. PHILLIPS, Prest. F. N. PHILLIPS, Treas. W. H. SAWYER, Secy.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, F. C. Ackerman, 16 Cortlandt St.
CHICAGO STORE, F. R. Donohoe, 241 Madison St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

THE ONLY
WATER-WHEEL GOVERNOR
THAT GOVERNS.

WATERVILLE & FAIRFIELD RAILWAY & LIGHT CO.,
WATERVILLE, ME., Jan. 18, 1896.

Lombard Water-Wheel Governor Co., Boston, Mass.

GENTLEMEN:—In regard to your Type C governor, which is regulating for us our two Hercules Wheels, which give power to operate our Light Plant, Street R. R. and Power Generator, we are frank to admit that the machine does its work admirably. We have no hesitancy in recommending it to those in want of a governor.

(Signed)
I. C. LIBBY, President Waterville & Fairfield R. R. & L. Co.

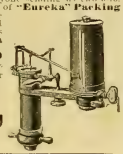
LOMBARD WATER-WHEEL GOVERNOR CO.,
61 Hampshire St., BOSTON, MASS.

The Handsomest

Pack of playing cards are sent to everyone sending us two 5-lb or one 10-lb. labels cut from the front of "Eureka" Packing boxes. An artist's model posed for the JOKER; the ace and backs are special designs. You know "Eureka." It's better than any other. Try Eureka

• INDICATORS. •

If we can afford to sell you on very easy terms, can't you afford to buy? Send for catalogue and installment terms. We have twenty-five other high grade specialties.



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204 Fulton Street, New York.
12 Pearl Street, Boston.

WIRE GUARDS
And GUARDS to ORDER
For special purposes.
Write for Catalogue B.

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WIRE WORKERS, MANUFACTURERS AND JOBBERS.
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Consulting Engineer,
Electricity, Mechanics.
Solicitor of Patents
Expert in patent causes.
Suite 1657-59 Monadnock Bldg., - Chicago.

Frederick Sargent. A. D. Lundy. Martin J. Insull.

SARGENT & LUNDY,
ENGINEERS,
13 and 15 Monadnock Block, CHICAGO, ILL.

GORDON PRIMARY CELL.
For Open and Closed Circuit Work.
The Perfect, Modern, Longest Lived and Most Economical Cell Ever Put on the Market.

In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM:—Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cleanest; not freezing at 32° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 25% ampere hours; for No. 2 cell, 100 ampere hours; on open circuit, 2.50 to 1 volt; on closed circuit, .65 to .75 volt. Send for circular and price list.

THE GORDON-BURNHAM BATTERY CO.,
82 to 86 West Broadway, New York City.
GEO. W. PATTERSON, 1114 Marquette Bldg., Chicago, Ill.

EVERYTHING IN WIRE.
BARE AND INSULATED.
ALSO MANUFACTURERS OF THE "CHICAGO" RAIL BOND.

WASHBURN & MOEN MFG. CO.,
WORCESTER, MASS.
BRANCH OFFICES AND WAREHOUSES: New York, Chicago, San Francisco, Houston, Philadelphia, Pittsburg, Boston.

A GOOD THING!

"CLEANOR."
THE MOST EFFECTIVE CLEANER EVER PUT ON THE MARKET. Indispensable for cleaning Street Cars, Telephone Boxes and other electrical or other woodwork. A boon for tidy station managers. Used extensively by Street Railway Companies, Hotels, Theaters and Furniture Dealers for renovating. Makes woodwork and furniture look like new, and Does it Without Rubbing. Removes dust, dirt, grease and oil, leaving the finish as fresh as the day it was put on. No trouble to use it. No water to splash around and drip, and does the work quickly and easily. The only preparation that leaves the finish absolutely clear and unclouded. If your dealer does not handle it, write us direct.

2 oz. cans ... price, 15c. each, $1.60 per doz. 4 oz. cans ... price, 25c. each, $2.75 per doz.
Quart cans ... price, $1.00 each, $11.00 per doz.

THE McDERMID MFG. CO., 205 S. CANAL ST., CHICAGO, ILL.
Agents Wanted.

Do Not Throw Away
YOUR OLD LAMP BASES.

We buy them and pay spot cash. If you will send us samples of the different kinds of bases you have on hand, and the number of each, we will let you know by return mail how much we will pay for same.

J. F. VOICE & CO., 644 10th Street, Milwaukee, Wis.

ELECTRO-MAGNETS.
THE VARLEY DUPLEX-MAGNET CO., 138 Seventh Street, JERSEY CITY, N. J.

The Emerson Electric Mfg. Co.,
Alternating Current Fan Motors, Ceiling Fans, Power Motors.
Knife Switches and Switch Boards, Multiple Fuse Boards, Push Buttons.
ST. LOUIS, U. S. A.

The Brady Mast Arms.
T. H. Brady, New Britain, Conn., U. S. A.
Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work.—Catalogues and Prices furnished on application.

CIRCUIT BREAKERS.
WARD LEONARD ELECTRIC COMPANY,
BRONXVILLE, N. Y., U. S. A.

INDIA AND AMBER
MICA
Uncut Or Cut to any Size or Pattern. Washers.
SAMPLES AND QUOTATIONS FURNISHED.
A. O. SCHOONMAKER, 1563 Monadnock Block, CHICAGO, ILL.

"To Selling Agencies:"

A new company recently organized, and at present engaged in equipping extensive and modern works for the manufacturing of a large line of new and improved machinery for heavy steam plant work, desire to open correspondence with selling agencies and dealers of experience in Water Tube Boilers, Engines or Electrical Machinery, who are desirous of either adding to their present business or of making changes looking to more profitable connections. Everything offered by this company will be a distinct advance in efficiency and general merit over anything on the market, and the new feature by which such ends are attained will be entirely original. Fullest investigation is solicited.

ADDRESS BOX 438,
MARION, OHIO.

WEATHERPROOF WIRE.
COMPLETE STOCK CARRIED BY
Western Electric Co., New York.
Electric Appliance Co., Chicago.
Pettingell Andrews Co., Boston.
Electrical Engineering Co., Minneapolis.
St. Louis Electrical Supply Co., St. Louis.
The Bradford Belting Co., Cincinnati

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

Phillips Insulated Wire Co.,
Office and Factory: PAWTUCKET, R. I.

WANTED—SITUATION.

Practical engineer and electrician desires change; would correspond with parties wishing all-round man and hustler in any work connected with plant. Salary moderate; strictly temperate. Best of references as to ability and character. Address "Box 144," care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

WANTED.

Position as manager or superintendent of an electric light plant or street railway; have had six years' experience in electric lighting, power, and railway work. Non-paying plants made to pay a specialty. Address "Electrician," 33 Fitzee St., Battle Creek, Mich.

WANTED.
ARMATURES TO REWIND.

Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years experience. Light plants installed complete. Send for prices.

HODGE, WALSH & LORING,
701 Delaware St., KANSAS CITY, MO.

FOR SALE.

Second hand Arc Lamps of different manufacture: good as new and thoroughly tested; also, Arc and Incandescent Dynamos and other electrical apparatus.

Always in the market for scrap Dynamos, Motors, Wire, Copper, burned out Incandescent Lamps and Lamp bases, etc. Address **THE CORNMAN COMPANY**, 1134 Hamilton St., Cleveland, Ohio.

FOR SALE.

200 Westinghouse lightning arresters for trolley lines, at a bargain. Old material purchased. WALSH'S SONS & CO., Newark, N. J.

For Sale Cheap.

One A-30 T.-H. Alternator 1,000 v. Ironclad Armature with Exciter and Switchboard, with all instruments complete. One 45 k. w. Standard Generator 500 v. Compound Wound. One 15 h.-p. 500 v. Detroit motor. One 15 h.-p. 500 v. Commercial motor. One 50 light 1,200 c. p. Arc Dynamo Standard. One 30 light 1,200 c. p. Arc Dynamo Sperry. **WILLIAM WRIGHT**, 939 Monadnock Building, Chicago.

FOR SALE—

CONTENTS OF TWO ELECTRIC LIGHT STATIONS.

One 30 K. W. Edison dynamo, compound wound.

One 50 K. W. Crescent dynamo, compound wound and multipolar.

Eight T.-H. 25 to 35 light arc dynamos, with 177 T.-H. arc lamps, about 2,000 c. p.

Four 500 to 1,000 light U. S. dynamos, compound wound.

Large stock of Automatic Engines from 25 to 300 h. p.

L. F. SEYFERT'S SONS, 437 to 441 N. 3rd St., Philadelphia, Pa.

For Sale—At Receiver's Sale,

All of the street railway property of the

DEFIANCE LIGHT & RAILWAY COMPANY.

A splendid opportunity for interurban extension. For particulars address

W. R. FABEN, Receiver, Defiance, O.

FOR SALE.

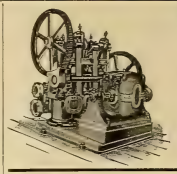
FIRST-CLASS ELECTRIC LIGHT PLANT

In county seat town, coal-producing county, in southern part of Ohio. Coal 50 cents per ton delivered. Two 85 horse power engines, one boiler, 1,500 light alternator, 60 light Wood arc machine. Income $5,000 to $6,000 per year. Will sell half interest to the right party at $5,500, or $10,000 cash for entire plant, including eight-year contract with city and 25-year franchise. Address "S. & M.," care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago, Ill.

FOR SALE.

On Saturday, February 19th, I will offer at public sale the plant of The Ohio Buggy Co., fronting on Fourth and Naghten Sts., 120x187½ ft., consisting of three-story and basement brick building, fronting 125 ft. on Fourth St., 1 four-story brick wing, 1 three-story brick wing, 1 one-story brick blacksmith shop and engine room, 1 three-story frame dry house, 1 two-story frame barn. Brick buildings contain 80 h. p. engine, two boilers and all connections, about 200 ft. line shafting, 2 power elevators, about 45,000 ft. floor space. Located within two squares of three trunk line freight stations. Adapted for manufacturing vehicles, books and shoes, electrical appliances, bicycles, etc., appraised at $75,000. C. W. BLACK,

Special Master Commissioner, Columbus, O.



SMITH-VAILE TRIPLEX PUMPS.

OPERATED BY ELECTRIC MOTOR.
SINGLE AND DOUBLE ACTING.

HOUSE PUMPS, ELEVATOR PUMPS,

WATER WORKS PUMPS, ETC.

ALSO

Pumping Machinery for Every Possible Duty. New Catalogue Free.

Manufactured by

THE STILWELL-BIERCE & SMITH-VAILE CO.,
DAYTON, OHIO, U. S. A.

MARLO IRON BOX BELL

Is the Only Double Adjustment Bell That

Cannot Get Out Of Adjustment.

PROCTOR-RAYMOND MFG. CO.,
Buffalo, - N.Y.

Goldsmith Bros.,

PLATINUM REFINERS,
63 Washington Street, Chicago, Ill.
Highest Cash Price Paid for Platinum Scrap.
Platinum Wire and Plate For Sale.

Second-Hand Engines.

for sale cheap by **The American Engine Co.**, builders of the American-Ball Engines and Electrical Machinery, Round Brook, N. J.

FOR SALE.

SECOND-HAND

Direct current dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,330, 1,610 and 2,500 lights capacity.
Alternating current dynamos of 750, 900, 1,300, and 2,000 lights capacity.
Arc dynamos 20, 24, 30, 40, 50 and 60 lights, both 1,200 and 2,000 c. p.
Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 h. p.
Boilers, 100, 250, 375 and 500 h. p.
Heaters, 150 and 1,000 h. p.
Pumps, all sizes.

WRITE FOR PARTICULARS AND PRICES.

CHICAGO EDISON COMPANY, - - 139 Adams Street, Chicago.

FOR SALE!

2 1000-LIGHT INCANDESCENT DYNAMOS.
2 1200-LIGHT INCANDESCENT DYNAMOS.

ALSO IN MARKET FOR CLEAN COPPER SCRAP, COPPER WIRE AND COMMUTATOR SEGMENTS.

LUCIUS A. HINE & CO., 16 N. Canal Street, CHICAGO.

BUY YOUR BOOKS

FROM THE

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ELECTROTYPES.

CHICAGO ELECTRO. & STEREO. CO.,
149-155 Plymouth Place, Chicago.

REPAIRS—ST. LOUIS.

MORRELL ELECTRIC WORKS,
25 S. 8th St.

MAST ARM

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for Descriptive Circular.

Absolutely Non-Infringing. Protection Guaranteed.

AMERICAN BATTERY CO.,
ESTD 1886. 38 W. Quincy St., Chicago, Ill.

PROUTY Electro-Gasoline Engine

2 to 50 H. P.

Runs without smoke, odor or noise. Special styles for Electric Lighting, Boats, Mining Locomotives, Hoists, Portable, Traveling, Pumping, Farm and Dairies. Inspection and Stock Cars, Road Vehicles, Compressed Air Locomotives, Pumping, etc. All engines guaranteed and may be returned at our expense if not as represented. **THE PROUTY CO.,** 79 Dearborn St., Chicago, U.S.A.

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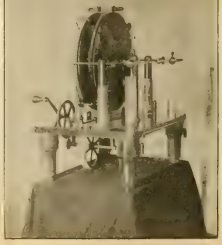

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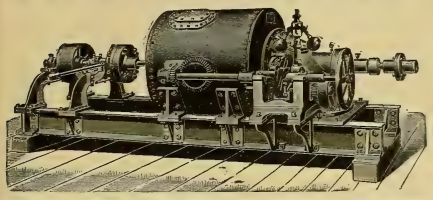

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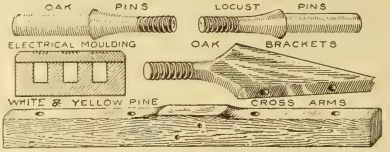

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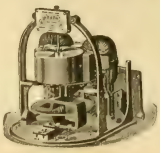

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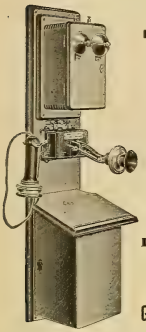

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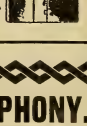

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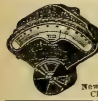

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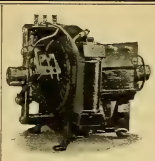

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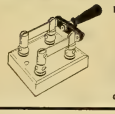

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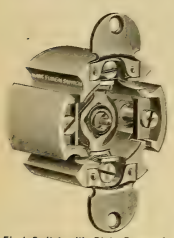

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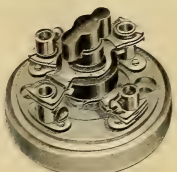

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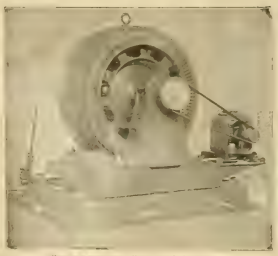

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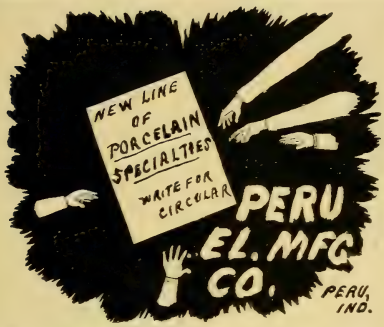

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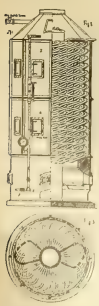

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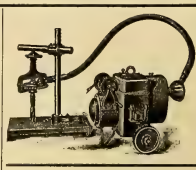

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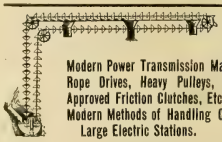

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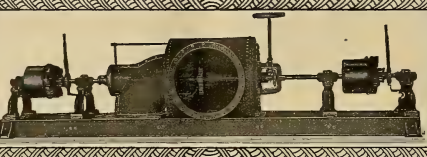

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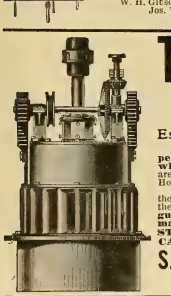

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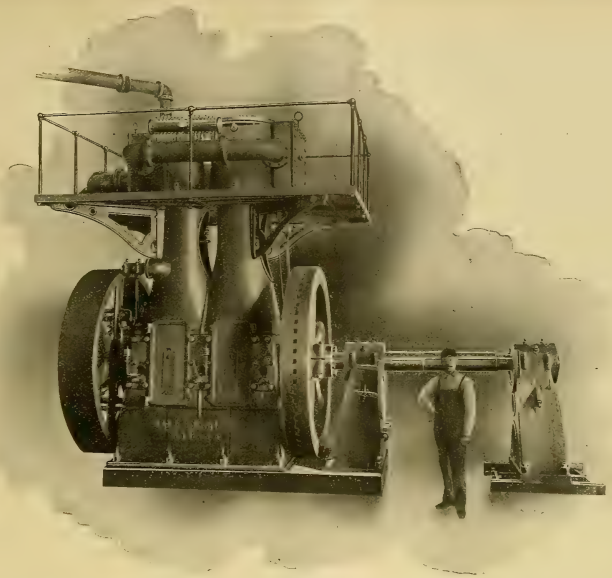

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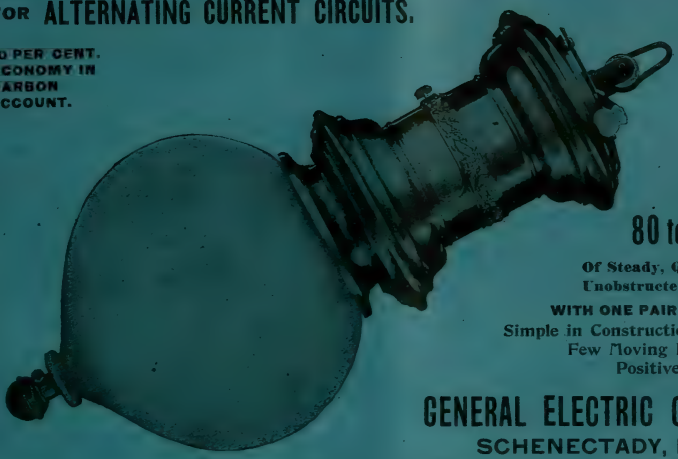

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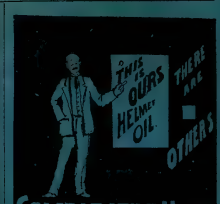

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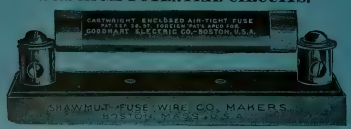

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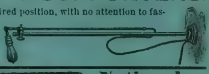

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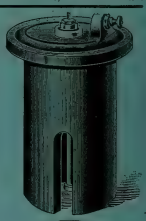

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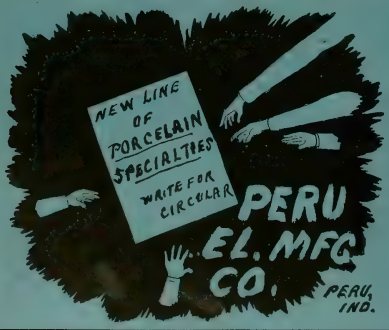

A WARNING

TO USERS AND PURCHASERS OF

KEYSTONE INSTRUMENTS.

We have recently learned that an unscrupulous contracting and manufacturing concern is supplying their trade with alleged modern "Keystone Instruments," which are in reality old instruments made by us years ago and purchased by them at second hand, they changing them in range and character to meet the requirements of their orders. These old Instruments are lacking in many of the improvements which make our modern line so desirable, and in addition have been botched in the change by lack of knowledge and facilities.

In view of this we desire to inform the public that every Instrument shipped from our factory is accompanied by a certificate duly signed, giving the serial number of the Instrument, its range and date of calibration.

We would warn the public to accept no Keystone Instruments unless accompanied by such a certificate.

Keystone Electrical Instrument Co.,

NINTH STREET AND MONTGOMERY AVE., PHILADELPHIA.

NEW YORK. BOSTON, CHICAGO.

Makes No Noise, Makes Money.

What the other man says.

It requires litte effort of imagination or self-conceit for a manufacturer to praise his own product, but the man who pays his good money for it looks at things from an entirely different point of view.

Mr. Owen, of the Onarga Electric Light and Water-works, Onarga, Ill., says: "*We take pleasure in stating that the machine has run constantly since starting it up (August, 1895), has never given us a moment's difficulty. Have never had to stop for any adjustment of bearings; never burned out a coil or had the slightest trouble in any way.*"

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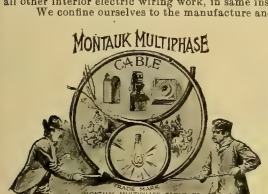
We confine ourselves to the manufacture and sale of this cable exclusively, it being auxiliary to all other electric interests.



By the use of this cable every infinitesimal part of every wire hereafter installed for whatever purpose in all buildings is made a detective point for the discovery and automatic notification of fire. We have opened up a new and rich field for the electrical contractor. If you are not acquainted with us and the cable, you should be. Write or call and become so.

Write for illustrated and descriptive printed matter.

We own the sole and exclusive right to manufacture and sell the Montauk Multiphase Cable and Central Station Controller, by virtue of the following patents: No. 546,261, Sept. 10, 1895; No. 546,262, Sept 10, 1895; No. 565,053, Aug. 4, 1896; No. 565,178, Aug. 4, 1896; No. 565,188, Aug. 4, 1896; No. 565,217, Aug. 4, 1896; No. 565,410, Aug. 4, 1896; No. 594,034, Nov. 23, 1897; No. 594,247, Nov. 23, 1897; No. 594,281, Nov. 23, 1897, which broadly cover not only the method of manufacturing, but the basic principle upon which these cables are constructed.

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Efficient, Long-Lived and Guaranteed Satisfactory.

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OUR SPECIALTY.

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Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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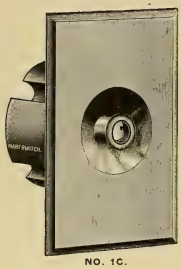

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HART LOCK FLUSH SWITCH.

Removable key. The lock attachment can also be applied to our Gang Plates and **Standard** Switches.

Lock Switches are Desirable in Many Cases.

See our Illustrated Catalogue for further information.

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Hartford, Conn.

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BRYANT-PAISTE SWITCH.

PRICES GREATLY REDUCED.

WRITE YOUR JOBBER FOR REVISED FIGURES.

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Dry Batteries.

A HIGH-GRADE BATTERY AT A FAIR PRICE.

I have made **1,250,000** dry batteries for **other companies,** am now making the "New Standard" for myself, the result of over **eight years' close study,** and is absolutely the **highest grade** on the market.

Specially constructed for all open circuit work; will guarantee it is beyond comparison with any other cell for

Economical Telephone Service.

Give it a trial, be convinced and begin to save money on battery account. A comparative test with any other battery will prove above statement correct.

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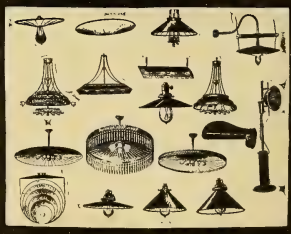

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CHICAGO.

The Zamel Arc Light Meter

AND ELECTRIC CURRENT TIMER

Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights,

It Is Positive in Its Action.

SEND FOR CIRCULAR.

Zamel Arc Light Meter Co.,

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Approved by the National Fire Underwriters' Association.

It Is Folly to Install Good Machinery

To supply current to poor lamps, the lamp being **end, aim** and **test** of the lighting system. If, however, you are looking for quality in your **incandescent lamps** try the

"HARDY."

Sustained Candle Power Is Its Strong Point.

To prove it, we will send you by express, charges prepaid, one dozen 16 c. p., 3 or 3½ watt Lamps, any base, any voltage, from 45v. to 125v. for $2.16; or 200v. to 250v. for $3.86.

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MANUFACTURERS OF

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THIS IS WHAT WAS LEFT—AFTER HE "WENT AGAINST IT"!

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ST. LOUIS.

THE S-W Arc Light Radiators

BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.
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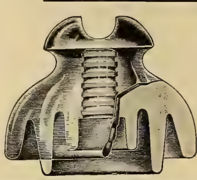

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Insulators for High Voltage Power Transmission, Electric Railway, Electric Light, Telegraph and Telephone Lines.

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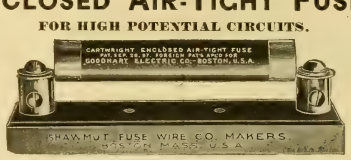

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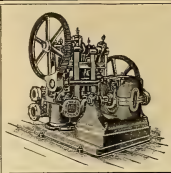

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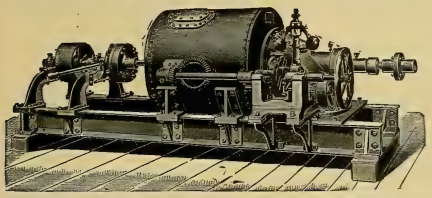

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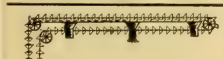

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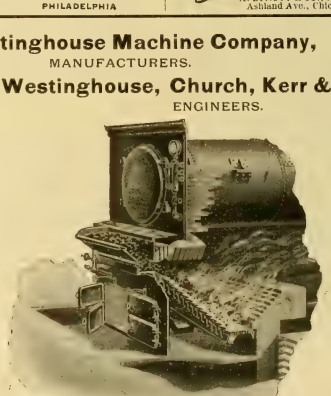

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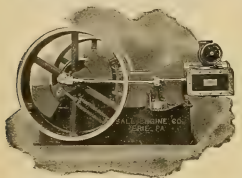

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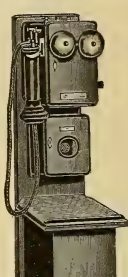

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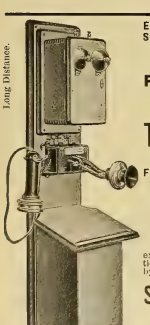

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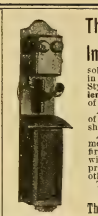

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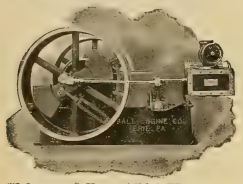

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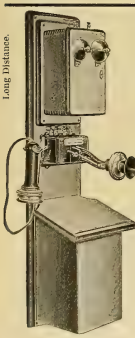

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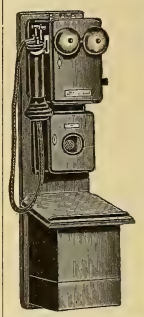

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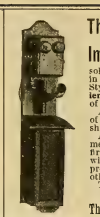

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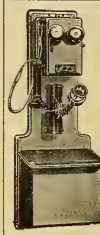

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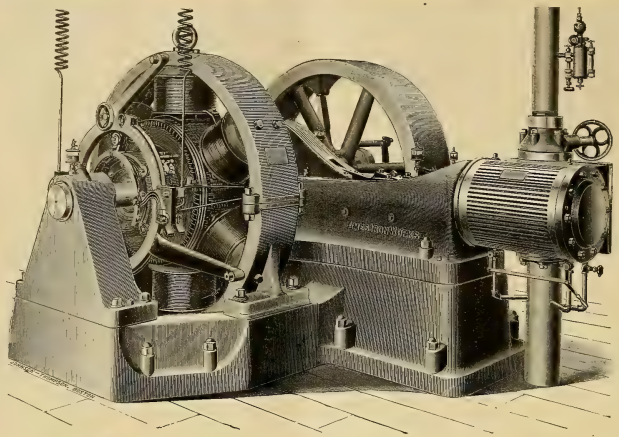

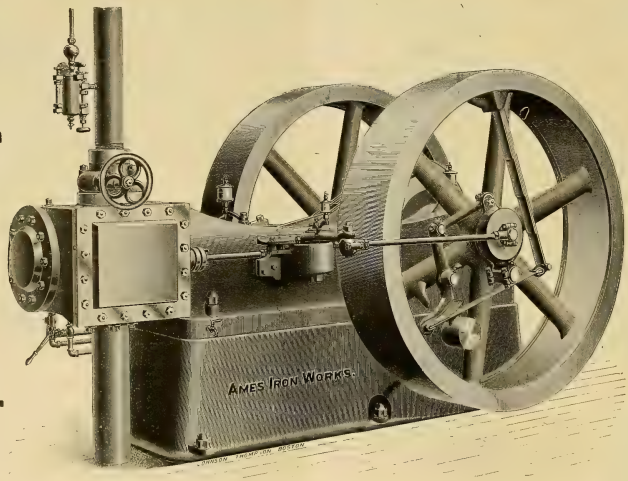

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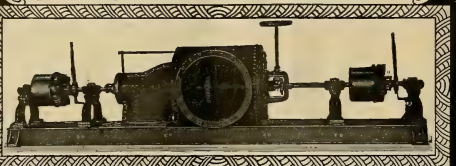

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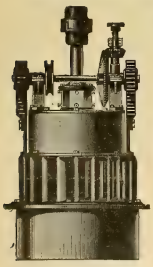

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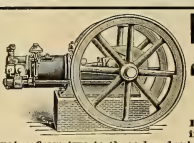

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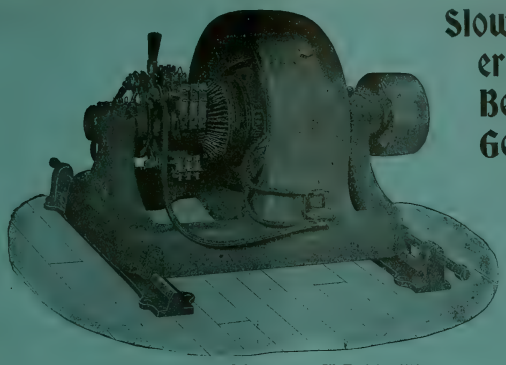

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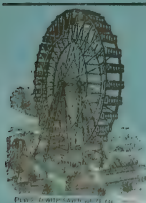

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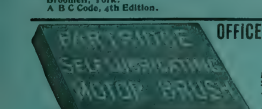

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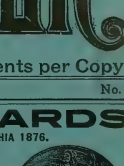

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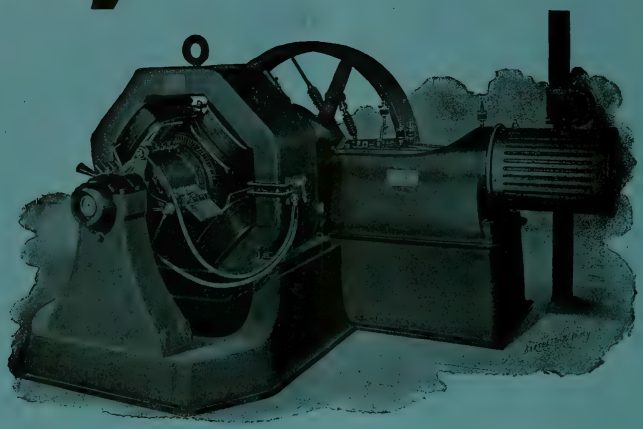

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We having received a very large shipment of

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Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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General Western Agents, 139 Adams Street, Chicago.

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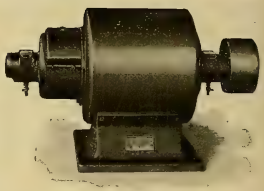
Storey Motors.



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Specially Adapted for Direct Connection to Machinery.

Special Direct Current Motors for All Classes of Work.

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The Zamel Arc Light Meter

AND ELECTRIC CURRENT TIMER

Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights.

It Is Positive in Its Action.

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Zamel Arc Light Meter Co.,

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We respectfully announce that we succeeded to the business of the Willard Electric & Battery Company some two months ago, that we have admitted to our partnership Mr. T. A. Willard and H. M. Hawley, and that the business will hereafter be conducted under the firm name of SIPE & SIGLER.

During the past two months we have been busily engaged in fitting up our power building with the finest special machinery for the **rapid and perfect manufacture of Willard Storage Batteries,** and we are now prepared to deliver with reasonable promptness Willard Batteries of any size and for any purpose.

While we have equipped our building—which, by the way, is one of the most perfectly appointed power buildings to be found—for the manufacture of the largest storage batteries, yet we are as well prepared to supply smaller ones.

We make plates in all sizes from 5 in. x 7 in. to 18 in. x 32 in. We also make the concentric type in the smaller size down to five ampere hours capacity.

We respectfully request anyone interested in storage batteries for whatever purpose, and especially for large power or lighting plants, to investigate the mechanical and electrical construction of the Willard Battery.

We invite inquiry and court scientific tests, and we will take pleasure in supplying anyone with the means by which he may inform himself as to the merits of the Willard Battery.

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As an encouragement for interested parties to make scientific tests and comparisons, we will supply a single cell of any size for this purpose **AT ONE-HALF OUR NET PRICE** to any reputable dealer or electrical engineer upon receipt of the order below, signed by such dealer, engineer or other person interested in storage batteries.

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1st. That each cell will equal or exceed its rated capacity.

2nd. The high efficiency at high rate of discharge.

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4th. That the cell may remain discharged for a long period without ill effects, which treatment would be fatal to the average storage battery.

Beyond these exceedingly important features there are many advantages that a test will develop, and which we leave to your determination.

MESSRS. SIPE & SIGLER:

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W. E. .....

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Perfection Drop Elevator Annunciators.

NEVER FAIL TO WORK.

Are not affected by jars.

Freight allowed to Chicago on all orders.

PRICES RIGHT FOR QUALITY.

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BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.
Will give exclusive agency to responsible house in principal cities.

SHADOWLESS RADIATOR MFG. CO.,

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Central Mfg. Co.
Commercial El. Supply Co.
Electric Appliance Co.
Electric Sp. Equipment Co.
Parr Tel. & Cons. Sup. Co.
Locke, Fred. M.
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Bossert Elec. Const. Co.
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Cutter E. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Hill, W. S. Electric Co.
K. & W. Company.
Pale Co., H. T.
Peoples Electric Co.
Peru Elec. Co.
Reliable Elec. Supply Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse E. & Mfg. Co.
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American Engine Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Keystone Electric Co.
Nott & Co., A. D.
Roth Bros. & Co.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warner, Wm. F.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wright, Wm.
Economizers, Fuel.
Broomell, Schmidt & Co.
Hall Economizer Co.
Electric Meters.
American El. Meter Co.
Zamel Arc Light Meter Co.
Electric Railways.
General Electric Co.
Walker Company.
Westinghouse El. & Mfg. Co.
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American Elec. Eng. Assn.
Bain, Peroe.
Broughton, H. P.
McRae, A. L.
Sargent & Lundy.
Westinghouse, Church, Kerr & Co.
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Central Electric Co.
Cherry Electric Works.
Commercial El. Supply Co.
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General Electric Co.
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Keystone Instrument Co.
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Paiste Co., H. T.
Queen & Co.
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Weston Electrical Inst. Co.
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Commercial El. Supply Co.
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Perry Mfg. Co.
Vought, M. I.
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Varley Duplex-Magnet Co.
Electro-Plating Mach'y.
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Hobart Mfg. Co.
Nott & Co., A. D.
Roth Bros. & Co.
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Foos Gas Engine Co.
Otto Gas Engine Wks.
Prouty Co., The.
Engines, Steam.
American Engine Co.
Ames Iron Works.
Armington & Sims Co.
Ball Engine Co.
Sweet's Leverless.
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Emerson El. Mfg. Co.
Parr Tel. & Cons. Sup. Co.
General Electric Co.
Roth Bros. & Co.
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Walker Company.
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Davis & Son, J. B.
Fibre.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Keravers Mfg. Co.
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Barnett Co., G. & H.
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Stow Mfg. Co.
Fuses.
D. & W. Fuse Co.
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Electric Appliance Co
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Western Electric Co.
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Pratt & Whitney Co.
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Ansonia Electrical Co.
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General Electric Co.
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Hill, W. S. Electric Co.
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Paiste Co., H. T.
Partrick, Carter & Wilkins.
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Queen & Co.
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Brixey, W. R.
Bryan Electric Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Kartaverr Mfg. Co.
K. & W. Company.
Locke, Fred. M.
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New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
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Simplex Electrical Co.
Standard Underground C. Co.
Warner Elec. Mfg. Co.
Western Electric Co.
Insulated Wires and Cables, Magnet Wires.
American Electrical Works.
Brixey, W. K.
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Chicago Edison Co.
Chicago Ins. Wire Co.
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General Electric Co.
Montauk Multiph. Cable Co.
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New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
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Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
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Parrot Mfg. Co.
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Puritan Electric Co.
Lamps, Incandescent.
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Central Electric Co.
Chicago Electric Co.
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Electric Appliance Co.
General Electric Co.
K. & W. Company.
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United Elec. Imp. Co.
Western Electric Co.
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Lightning Arresters.
Central Electric Co.
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General Electric Co.
Westinghouse El. & Mfg. Co.
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(See Insulated Wires.)
Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Pratt & Whitney Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Valle
Westinghouse, Church, Kerr & Co.
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Commercial El. Supply Co.
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Schoonmaker, A. G.
Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.
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American Engine Co.
Card Electric Co.
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Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
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General Electric Co.
Hobart Elec. Mfg. Co.
Keystone Electric Co.
Northern Electl. Mfg. Co.
Peoples Electric Co.
Roth Bros. & Co.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wright, Wm.
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Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co
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Central Electric Co.
Commercial El. Supply Co.
Phoenix Paint Co.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd
Platinum.
Baker & Co.
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National Tank Works Co.
Perrizo & Sons.
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Stone Lumber Co.
Torrey Cedar Co.
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Bryant Electric Co.
Central Electric Co.
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Peru Elec. Mfg. Co.
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Shadowless Radiator Mfg. Co.
Rails.
Goldsmith Bros.
Swarts Metal Refining Co.
Rectors.
Amer. Rectector & Ltg. Co.
Shadowless Radiator Mfg Co.
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Chicago Edison Co.
Elliott, W. H. Elec. Co.
Hodge, Walsh & Loring.
Morrell Electric Works.
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American Rheostat Co.
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General Electric Co.
Leonard, Ward. Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.
Second-Hand Machin'y.
Bauz, F. A.
Corrman Co.
Elliott, W. H. Elec. Co.
Hine & Co., L. A.
Hodge, Walsh & Loring.
Wright, Wm.
Shades.
Amer Reflector & Ltg. Co.
Central Electric Co.
Spark Arresters.
K. & W. Company.
Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Partrick, Carter & Wilkins.
Western Electric Co.
Speed Indicators.
Besly & Co., Chas. H.
Central Electric Co.
Keystone Sl. Instrument Co.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.
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Bossert Elec. Const. Co.
Steel Pipe.
National Tube Works Co.
Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
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American Electrical Works
Brixey, W. R.
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Commercial El. Supply Co.
Electric Appliance Co.
Moore, Alfred H.
New York Insulated Wire Co
Okonite Co., The.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Underground C. Co.
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Commercial El. Supply Co
Farr Tel. & Cons. Sup. Co.
Holcomb Elec. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Lockwood T. & T. Co. of Am.
Northwest Engineering Co.
N. W. Tel. Mfg. Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Stromberg-Carlson Tl. M. Co.
Tabet & Mayer.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Cons. Co.
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Roth Bros. & Co.
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Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co
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Central Electric Co.
Samson Cordage Wks.
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Am. Impulse Wheel Co.
Dayton Globe Iron Works Co
Leffel & Co., The.
Pelton Water Wheel Co.
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Stilwell-Bierce Smith-Valle
Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
Western Electric Co.
Woodwork, Electrical.
Cahoon Mfg. Co.
X Ray Outfits.
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Edison Lamp Dept.
Queen & Co.
Sweet & Lewis Co.

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DIEHL FANS

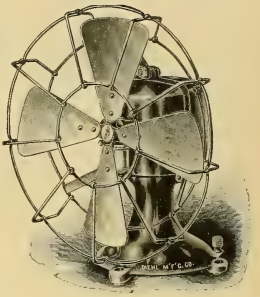
FOR ALL CIRCUITS, EXCEPT ALTERNATING.

OUR CEILING FANS AND ELECTROLIERS
ARE THE

Recognized Standard
OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency
Of Any on the Market.



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ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway.
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BOSTON: 128-132 Essex St.

DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

The Swinging Tree Insulator

Manufactured by

WESTERN ELECTRIC COMPANY.

This Tree Insulator will thoroughly protect your lines from swaying branches without cutting the insulation.

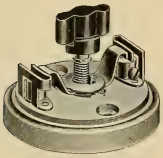
It is readily hung from a hook or wire twisted through the loop at the top, and by lengthening the wire can be adapted to a wide range of conditions.

It can be used with advantage for supporting arc light wires under iron roofs.

WESTERN ELECTRIC COMPANY,

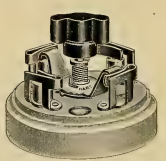
CHICAGO. NEW YORK.

Hart Switches for 500 Volt Circuits.



No. 20½. 5 Ampere, S. P.

No. 21½. 10 Ampere, S. P.



No. 23½. 5 Ampere, 3-Way.

These switches are guaranteed to work on 500 volt circuits without causing trouble or "playing out."

No. 21½ is especially designed for electric heaters.

Continued orders from customers who have used these switches for years is convincing proof that they perform their work in a satisfactory manner.

For particulars, see our illustrated catalogue.

All switches of our manufacture are stamped "Hart Switch" on the metal.

THE HART & HEGEMAN MFG. CO., Hartford, Conn.

THE S. K. C. SYSTEM.

A COMPLETE SYSTEM FOR

Long Distance Transmission, General Station Distribution, Mill and Factory Equipment.

Generators will be wound and guaranteed for an E. M. F. as high as

10,000 VOLTS.

CORRESPONDENCE SOLICITED

STANLEY ELECTRIC MANUFACTURING COMPANY,

Pittsfield, Mass., U. S. A.

THE ROYAL ELECTRIC CO., Montreal, Canada, are sole licensees for the manufacture and sale of the S. K. C. System in Canada. . . . . .

BRANCHES OFFICES:
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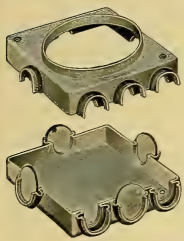
Boston Equitable Building.
New York 39 Cortlandt St.
San Francisco 800 California St.
Anderson S. C.
St. Louis, Mo., Western Electrical Supply Co.

GOOD CARBONS MEAN LESS COST FOR CURRENT. Therefore, wherever a highly efficient service is desired, it is of the utmost importance to use the best Carbons obtainable.

"All the excellence in dynamos and arc lamps counts for but little, when poor Carbons are used in the lamps."

NOTICE.—The "Electra" Highest Grade Nuernberg Carbons are, as heretofore, manufactured by the world-renowned firm of C. Conradty of Nuernberg. See that every package of my Carbons bears the label with my trade-mark "Electra," and thus beware of imitations. To protect the interest of purchasers of my Carbons, I am determined to proceed against infringers of my "Electra" trade-mark.

STEEL BOXES.



STEEL SPLIT BOXES FOR 5-8 CONDUIT.

NOTE the good points of this box!
NOTE that it is non-breakable!
NOTE the length of the projecting lugs!
NOTE that the inner rim of outlet is smaller than the outer!
NOTE from this that the conduit cannot run too far into box!
NOTE the removable discs!
NOTE that it weighs but 21 ounces!

If you have noted well all these good points you will have discovered the Best Split Conduit Box on the Market. Our new Catalogue "D" will tell you about our other 1,200 styles of Steel Outlet Boxes. We also manufacture Steel Boxes for Panel Boards.

THE BOSSERT ELECTRIC CONSTRUCTION CO., UTICA N. Y.

WHEN YOU BUY A MOTOR see that you get a[n] **AMERICAN** Rheostat with it.

Our Rheostats are unsurpassed either in workmanship or general finish throughout, and operate more satisfactorily than others.

WRITE US FOR CIRCULARS AND PRICES OF OUR

Automatic Motor Starters,
Field Regulators,
Speed Controllers,
Elevator Controllers,
Crane Controllers,
Automatic Overload Starters,
Pump Controllers,

RHEOSTATS FOR ANY PURPOSE.

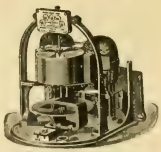
American Rheostat Co., Milwaukee, Wis.

TRANSFORMERS-WATTMETERS.

(SCHEEFFER'S IMPROVED.)

Double Primary Coils,
Double Secondary Coils,
Good Ventilation,
Light Weight,
High Efficiency,
Good Regulation,
Small Iron Loss,
Convenient to Install.

No Brushes,
No Commutator,
No Moving Wire,
Simplicity,
Durability,
Reliability,
Accuracy,
Even to a 6 c. p. Light.



DIAMOND ELECTRIC CO.,

MANUFACTURERS,

Office: 1202 Fisher Building, Chicago, Ill. Factory: Peoria, Ill.

KEYSTONE ELECTRIC CO., CHICAGO, ERIE, BOSTON.

: : Send us your specifications for **electrical equipments** and **installations**, however great or small. We build **electrical machinery** that will fill the **requirements** of the **most exacting.**

POWER AND LIGHTING GENERATORS, BELTED AND DIRECT CONNECTED.
MOTORS FOR ALL PURPOSES.

WE MANUFACTURE ARC LAMPS FOR ALL CIRCUITS.

Constant Potential Enclosed for 110 v.
C. P. Series Enclosed for 500 v. R. R.
Alternating Open Arc.
Constant Potential Series Open Arc.
Constant Current Series Enclosed.
C. P. Series Enclosed for 220 v.
Series Differential Open Arc.

OUR "A-B" METAL HANGER BOARD IS ACKNOWLEDGED "THE BEST" ON THE MARKET.

The Accompanying Cut Illustrates Our Constant Current Differential Open-Arc Lamp.

THE ADAMS-BAGNALL ELECTRIC CO., CLEVELAND.

AGENCIES: { McGILL & POMEROY, 1129 Monadnock Blk., Chicago, Ill.
WESTERN ELECTRICAL SUPPLY CO., 10 and 12 N. Ninth St., St. Louis, Mo.
C. W. PHIPPS, 222 Havemeyer Bldg., New York, N. Y.

HIGH GRADE INCANDESCENT LAMPS, With or Without Tips.

50, 110, 220 VOLTS OF ANY C. P. MOUNTED IN STANDARD BASES.

We offer our lamps in competition with any others on the market. The HIGHEST DEVELOPMENT in life, maintenance of candle power, commercial efficiency and good workmanship ARE WHAT WE HAVE TO OFFER.

We make no claim to wonderful inventions revolutionizing the art, or to the employment of all the lamp experts available.

Series Lamps for any service or socket. Responsible representatives wanted in large cities.

The UNITED ELECTRIC IMPROVEMENT CO.,

Allegheny Ave. and Nineteenth St., PHILADELPHIA, PA.

LOWEST QUOTATIONS ON ELECTRICAL SUPPLIES!

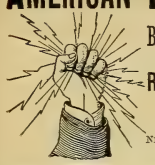
PROMPTEST SHIPMENTS!

RELIABLE ELECTRICAL SUPPLY CO., 236½ E. MADISON STREET, CHICAGO.

EUGENE F. PHILLIPS, Prest. F. N. PHILLIPS, Treas. W. H. SAWYER, Secy.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
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Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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CHICAGO STORE, F. E. Donohoe, 241 Madison St.
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THE ONLY
WATER-WHEEL GOVERNOR
THAT GOVERNS.

WATERVILLE & FAIRFIELD RAILWAY & LIGHT CO., WATERVILLE, ME., Jan. 18, 1896.

Lombard Water-Wheel Governor Co., Boston, Mass.

GENTLEMEN:—In regard to your Type G governor, which is regulating for us our two Hercules Wheels, which give power to operate our Light Plant, Street R. R. and Power Generator, we are frank to admit that the machine does its work admirably. We have no hesitancy in recommending it to those in want of a governor.

(Signed)
I. C. LIBBY, President Waterville & Fairfield R. R. & L. Co.

LOMBARD WATER-WHEEL GOVERNOR CO.,
61 Hampshire St., BOSTON, MASS.

The Handsomest
• INDICATORS. •

Pack of playing cards are sent to everyone sending us two 5-lb. or one 10-lb. labels cut from the front of "Eureka" Packing boxes. An artist's model posed for the JOKER; the ace and backs are special designs. You know "Eureka." It's better than any other. Try Eureka

If we can afford to sell you on very easy terms, can't you afford to buy? Send for catalogue and installment terms. We have twenty-five other high grade specialties.

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12 Pearl Street, Boston.

Circuit Breakers.
WARD LEONARD ELECTRIC CO.
BRONXVILLE, N. Y.

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Electricity, Mechanics,
Solicitor of Patents
Expert in patent causes.
Suite 1657-59 Monadnock Bldg., - Chicago.

Frederick Sargent. A. D. Lundy. Martin J. Insull.

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ENGINEERS,
13 and 15 Monadnock Block, CHICAGO, ILL.

GORDON PRIMARY CELL.
For Open and Closed Circuit Work.

The Perfect, Modern, Longest Lived and Most Economical Cell Ever Put on the Market.

In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM: Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cleanest; not freezing at 28° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 250 ampere hours, for No. 2 cell, 100 ampere hours, on open circuit, 2 to 1 volt, on closed circuit, .65 to .75 volt. Send for circular and price list.

THE GORDON-BURNHAM BATTERY CO.,
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GEO. W. PATTERSON, 1114 Marquette Bldg., Chicago, Ill.

EVERYTHING IN WIRE.
BARE AND INSULATED.
ALSO MANUFACTURERS OF THE "CHICAGO" RAIL BOND.

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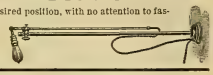

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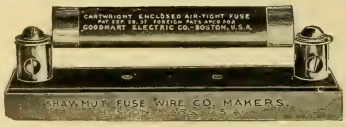

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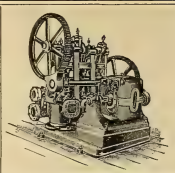

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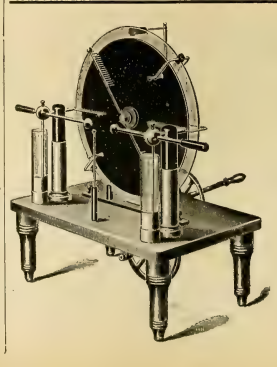

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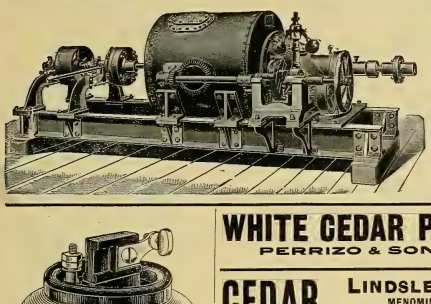

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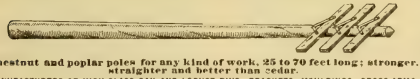

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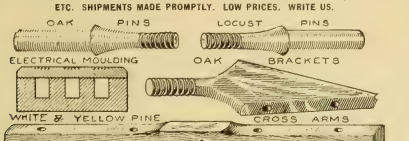

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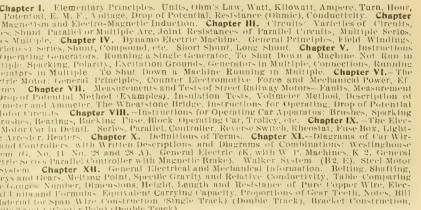

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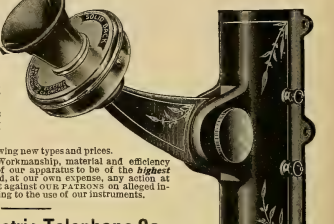

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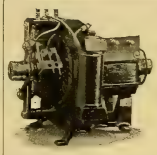

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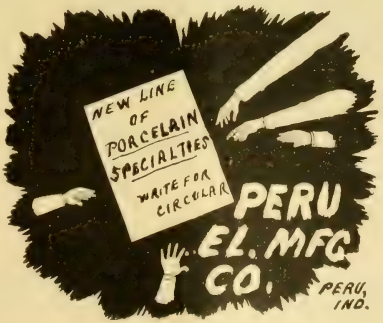

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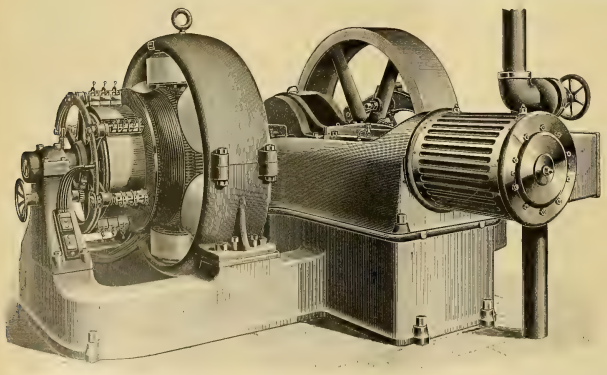

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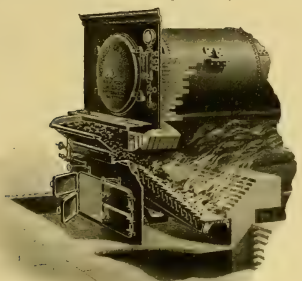

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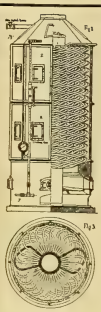

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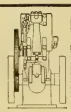

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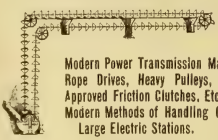

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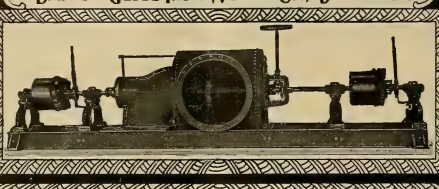

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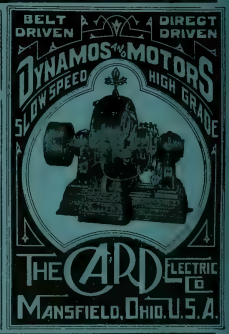

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Telephone, 608 Cortlandt.

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This meter has no springs, jewels or frictional errors.
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Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

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We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

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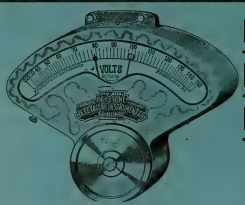

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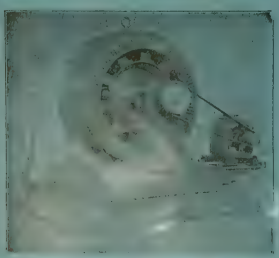

Facts.

The unctuous arguments and beguilements of a clever salesman are often used to cover a multitude of inherent defects in the machine he wants to sell. He adroitly avoids the vital points and seeks to convince with a meaningless philter of words.

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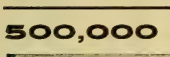

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1898

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We having received a very large shipment of

CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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COMMERCIAL ELECTRICAL SUPPLY COMPANY
SAINT LOUIS

- - THE - -

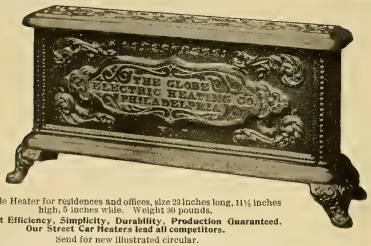
BRYANT-PAISTE SWITCH.

PRICES GREATLY REDUCED.

WRITE YOUR JOBBER FOR REVISED FIGURES.

THE BRYANT ELECTRIC CO.,
BRIDGEPORT, CONN. CHICAGO, ILL.

ELECTRIC HEATERS AVAILABLE TO ALL. MINIMUM EXPENSE.



Portable Heater for residences and offices, size 23 inches long, 11¼ inches high, 5 inches wide. Weight 30 pounds.

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Send for new illustrated circular.

Heating coils renewed like incandescent lamps. Constructed for any voltage. Work on direct or alternating current. Consumes 6. 8 amperes on 110 volt current, 1. 5 on 500 volt current.

THE GLOBE ELECTRIC HEATING CO., 147 North 12th Street, Philadelphia, Pa.

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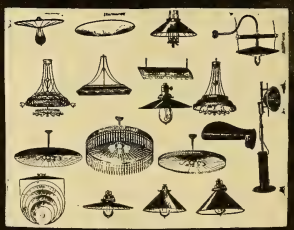

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CHICAGO.

The Zamel Arc Light Meter

AND ELECTRIC CURRENT TIMER

Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights,

It Is Positive in Its Action.

SEND FOR CIRCULAR.

Zamel Arc Light Meter Co.,

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Approved by the National Fire Underwriters' Association.

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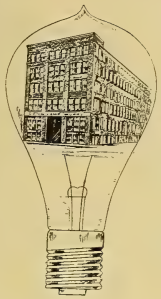
IN BARREL LOTS.



New Lynns, 20c.
Renewed, 15c.
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Equally good in life, uniformity of current consumption and maintenance of candle power.

Our **NEW LYNN LAMP** is perfection in style and general construction. **Write for circulars.**

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PIONEER IN LAMP RENEWING.

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INCANDESCENT LAMP SUPPORTERS.

Instant placement and fixture of lamp in any desired position, with no attention to fastenings. Adapted to every requirement from library to workshop. Send for catalogue C.

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WORCESTER, MASS.

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Is an Honest Lamp.

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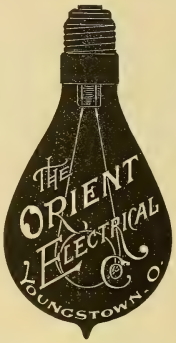


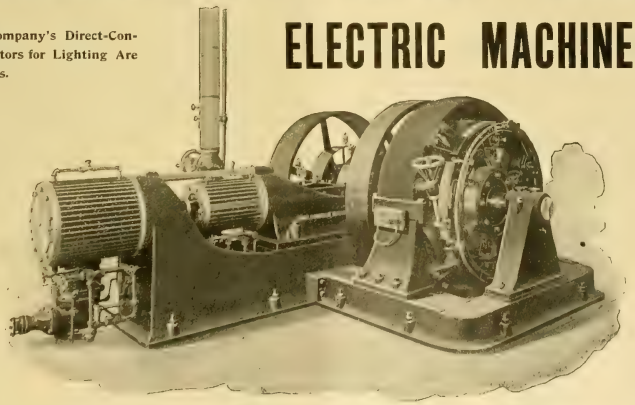
We do not make all kinds of **wild claims,** but can point to a larger proportion of **satisfied customers** than any other factory. If you are not using Orient Lamps write us. We can do you good.

Prices Always Below the Trust.

WALKER COMPANY,

ELECTRIC MACHINERY.

Walker Company's Direct-Connected Generators for Lighting Are Justly Famous.



You Cannot Get Better Than the Best, Which Is Walker Apparatus.

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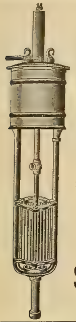
AGENCIES IN ALL PRINCIPAL CITIES.



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Arc Light Radiators
BRILLIANT AND ECONOMICAL.
Absolutely free from **side shadows**, or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.
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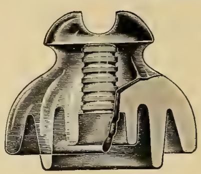

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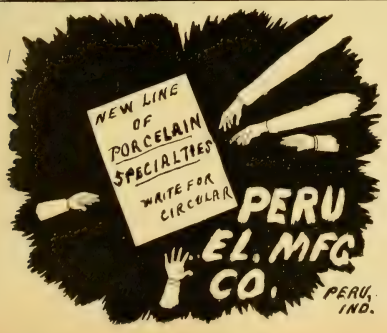
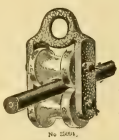


The Swinging Tree Insulator

Manufactured by
WESTERN ELECTRIC COMPANY.



This Tree Insulator will thoroughly protect your lines from swaying branches without cutting the insulation.

It is readily hung from a hook or wire twisted through the loop at the top, and by lengthening the wire can be adapted to a wide range of conditions.

It can be used with advantage for supporting arc light wires under iron roofs.

WESTERN ELECTRIC COMPANY,
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The name of
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is a guarantee.

Everybody Knows

That we make big machines and that others make little ones; but everybody does not know that we make little machines also.

The PHILADELPHIA PRESS of Sept. 19, 1897, gives "Holland's" interview with Lord Kelvin.

It says:

"Lord Kelvin seems to have been particularly impressed with all that he saw in the great yards of the Westinghouse Co.

"Lord Kelvin spoke of the Induction Motors there built, and added that he would be glad if he were able to say in print how greatly he had been impressed with the scientific work of Shallenberger and Scott in electrical measuring instruments, and other developments, as he had seen the work done there."

"Of course," continues "Holland," "that is extraordinary praise."

Tesla Polyphase, Type "C", Induction Motors,—the kind that have no moving contacts—can be started at any distance.

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TROLLEY POLES
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FACILITY of Trimming Mechanism.

DURABILITY of Entire Mechanism.

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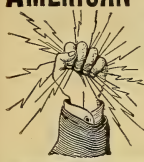

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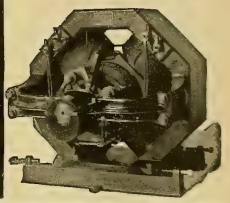

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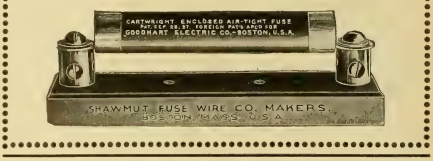

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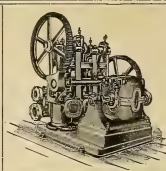

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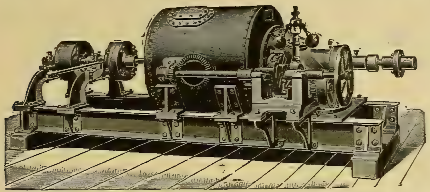

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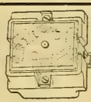

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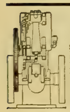

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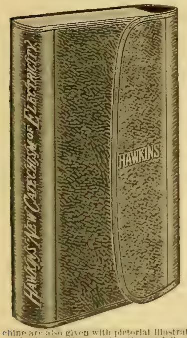

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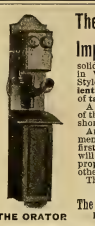

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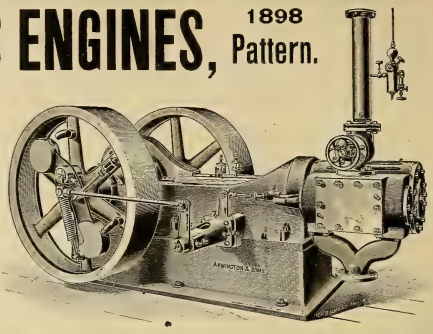

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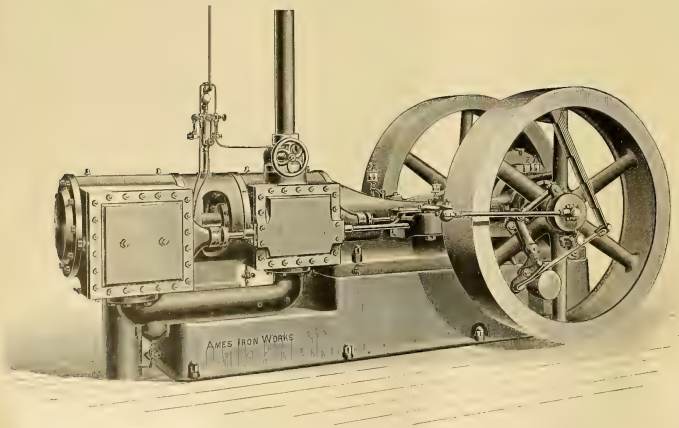

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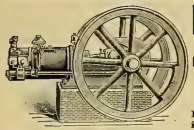

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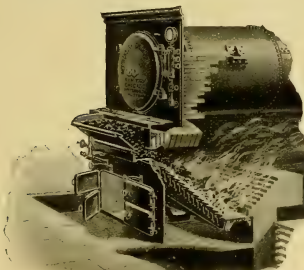

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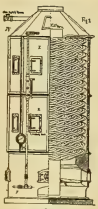

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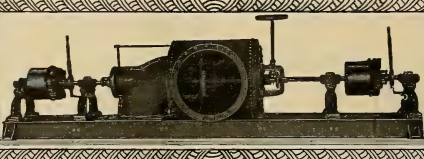

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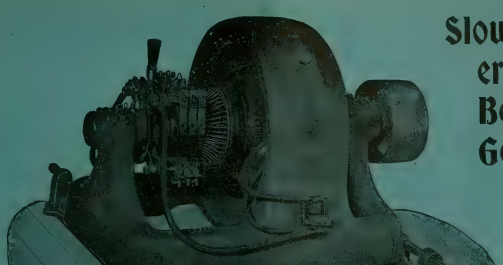

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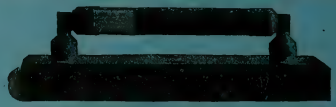

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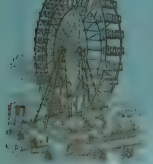

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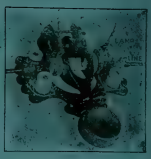

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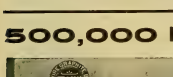

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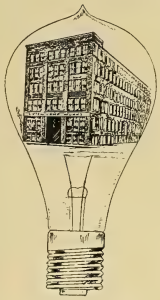

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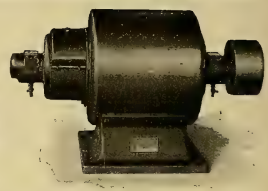

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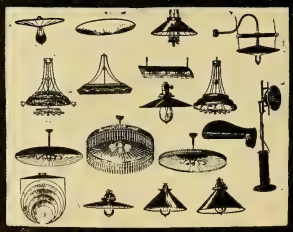

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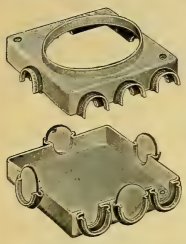

NOTE the good points of this box!
NOTE that it is non-breakable!
NOTE the length of the projecting lugs!
NOTE that the inner rim of outlet is smaller than the outer!
NOTE from this that the conduit cannot run too far into box!
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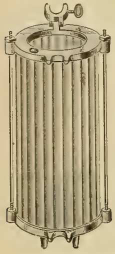

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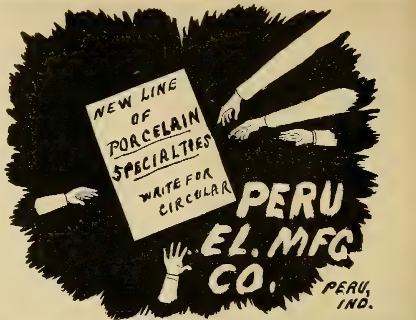

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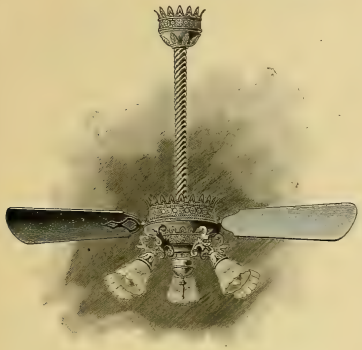

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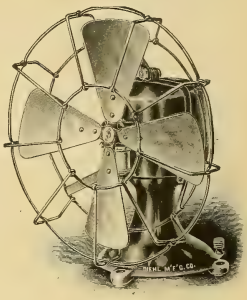

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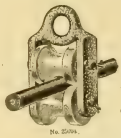

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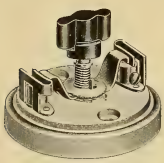

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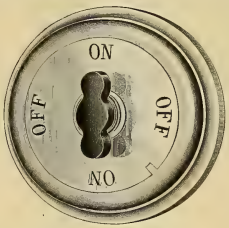

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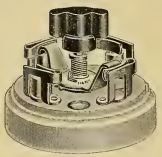

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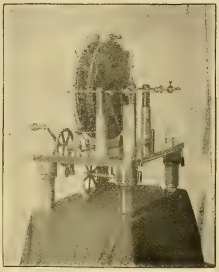

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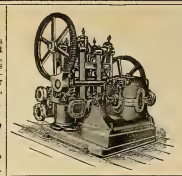
The said President and Trustees reserve the right to reject any or all bids.

Dated February 8, 1898.

Signed: **THE PRESIDENT AND TRUSTEES OF THE VILLAGE OF SHEBOYGAN FALLS, WIS.**



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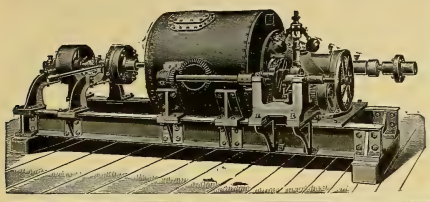

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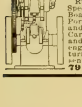

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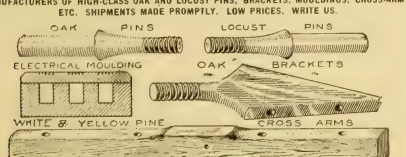

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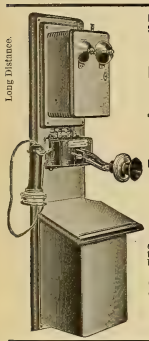

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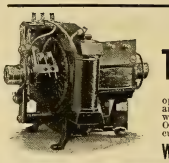

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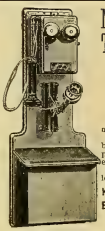

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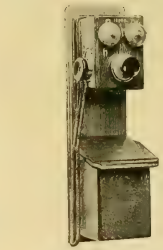

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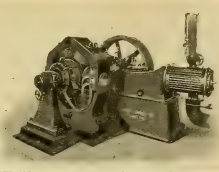

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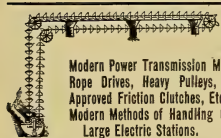

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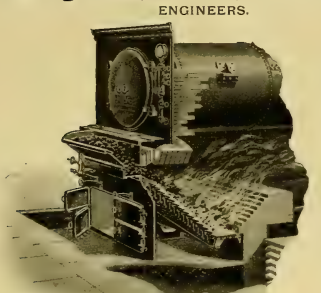

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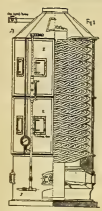

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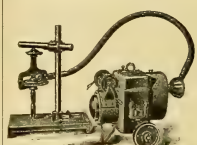

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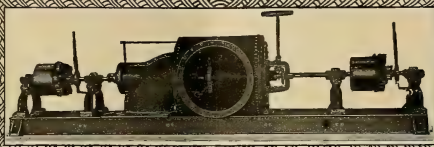

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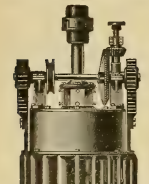

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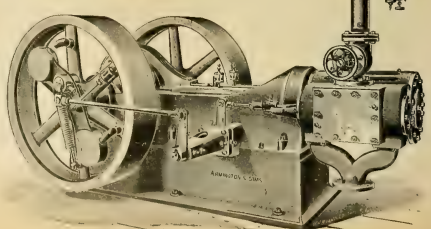

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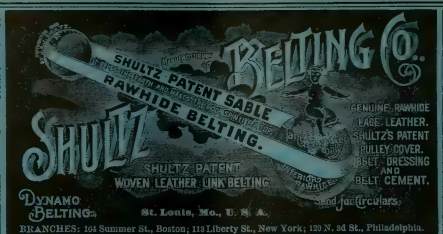

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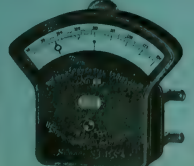

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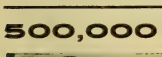

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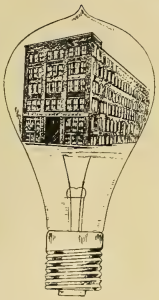

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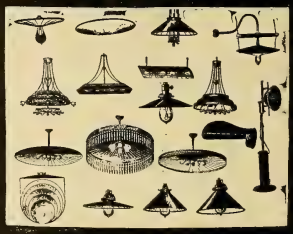

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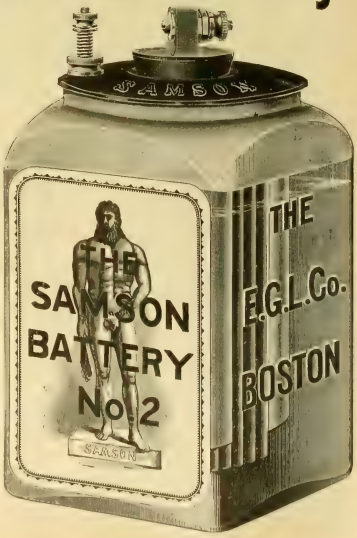

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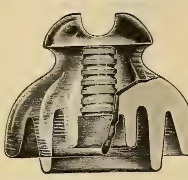

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Paiste Co., H. T.
Queen & Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Weston Electrical Inst. Co.
Electrical Specialties.
Commercial El. Supply Co.
Hill, W. S. Electric Co.
Ohio Elec Specialty Mfg. Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Vought, M. I.
Electro-Magnets.
Varley Duplex-Magnet Co.
Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.
Hobart Elec. Mfg. Co.
Nott & Co., A. D.
Roth Bros. & Co.
Engines, Gas.
Foos Gas Engine Co.
Otto Gas Engine Wks.
Prouty Co. The.
Wolverine Motor Works.
Engines, Steam.
American Engine Co.
Ames Iron Works
Armington & Sims Co.
Ball Engine Co.
Ide & Sons, A. L.
Skinner Engine Co
Westinghouse, Church, Kerr & Co.
Fan Outfits.
Commercial El. Supply Co.
Diehl Mfg Co.
Emerson El. Mfg. Co.
Farr Tel. & Cons. Sup. Co
General Electric Co.
Roth Bros. & Co.
Wagner Electric Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Feed Water Heaters.
Davis & Son, I. B.
Fibre.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.
Files.
Barnett Co., G. & H.
Fixtures, El. & Comb'n.
Commercial El. Supply Co.
Flexible Shafts.
Stow Mfg. Co.
Fuses.
American Elec. Fuse Co.
Fuse Wire.
Commercial El. Supply Co.
Electric Appliance Co.
Shawmut Fuse Wire Co.
Gaskets.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.
Robertson & Sons, Jas. L.
Gas Lighting, Electric.
Partrick, Carter & Wilkins.
Western Electric Co.
Gears.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Pratt & Whitney Co.
General Elec. Supplies.
Ansonia Electrical Co.
Besly & Co., Chas. H.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
Electric Ry. Equipment Co.
General Electric Co.
Hodge, Walsh & Loring.
Hill, W. S Electric Co.
K. & W. Company.
Manhattan Elec. Sup. Co.
Paiste Co., H. T.
Partrick, Carter & Wilkins.
Peoples Electric Co.
Peru Elec. Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.
Globes and Electrical Glassware.
Commercial El. Supply Co.
Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.
Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.
Hanger Boards.
K. & W. Company.
Induction Coils.
Queen & Co.
Insulators and Insulating Materials.
Ansonia Electrical Co.
Atlantic Alcatraz Asph. Co.
Brixey, W. R.
Bryant Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Kartavert Mfg. Co.
K. & W. Company.
Locke, Fred. M.
Mass. Chemical Co.
Mica Insulator Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Underground C. Co.
Wagner Elec. Mfg Co.
Western Electric Co.
Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co
Indiana Rub. & Ins. W. Co.
Montauk Multiph Cable Co.
Moore, Alfred F.
National Cond. & Cable Co.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cab. Co.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
Junction Boxes.
Bossert Elec. Const. Co.
Lamp Adjusters.
Faries Mfg. Co.
Vought, M. I.
White Co., O. C.
Lamps, Incandescent.
Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Commercial El. Supply Co.
Edison Lamp Dept.
Electric Appliance Co.
General Electric Co.
K. & W. Company
Lynn Incandescent Lp. Co.
Reliable Elec. Supply Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co
Westinghouse El. & Mfg. Co
Lightning Arresters.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.
Magnet Wire.
(See Insulated Wires.)
Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Pratt & Whitney Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile
Westinghouse, Church, Kerr & Co.
Mica.
Commercial El. Supply Co.
Munsell & Co., Eugene.
Schoonmaker, A. O.
Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.
Motors.
American Engine Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Northern Electl. Mfg. Co.
Peoples Electric Co.
Roth Bros. & Co.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wright, Wm.
Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.
Robertson & Sons, Jas. L.
Paints.
Atlantic Alcatraz Asph. Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.
Platinum.
Baker & Co.
Poles.
Berthold & Jennings.
Central Mfg. Co.
Electric Ry. Equipment Co.
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Naugle, Holcomb & Co.
Perrizo & Sons.
Point Marion Mfg. Co.
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Valentine-Clark Co.
Porcelain.
Bryant Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.
Radiators.
Shadowless Radiator Mfg. Co.
Refiners.
Goldsmith Bros.
Swartz Metal Refining Co.
Reflectors.
Amer. Reflector & Ltg. Co.
Shadowless Radiator Mfg. Co.
Re-Winding—Repairs.
Chicago Edison Co.
Elliott, W. H. Elec Co.
Hodge, Walsh & Loring.
Morrell Electric Works.
Rheostats.
American Rheostat Co.
Automatic Switch Co.
Cutler Hammer Mfg. Co.
General Electric Co.
Leonard, Ward, Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.
Second-Hand Machin'y.
Coruman Co.
Hine & Co., L. A.
Hodge, Walsh & Loring.
Wright, Wm.
Shades.
Amer. Reflector & Ltg. Co.
Spark Arresters.
K. & W. Company.
Speaking Tubes.
Electric Appliance Co.
Partrick, Carter & Wilkins
Western Electric Co.
Speed Indicators.
Besly & Co., Chas. H.
Keystone El. Instrument Co.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.
Steel Boxes.
Bossert Elec. Const. Co.
Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Hatch Storage Battery Co.
Street Cars.
Stephenson Co., John.
Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Bissel & Co., F.
Cabinet Mfg. Co.
Central Tel. & Elec Co.
Commercial El. Supply Co
Connecticut Tel. & El. Co.
De Veau & Co.
Electrose Mfg Co.
Ericsson Telephone Co.
Farr Tel. & Cons. Sup. Co.
Hammacher, Schlemmer & Co.
Holtzer-Cabot Elec. Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Lockwood T. & T. Co. of Am.
Logansport Tel. Mfg. Co.
Martin, Charles
McFell Electric Co.
Moon Mfg. Co.
Northwest Engineering Co.
N. W. Tel. Mfg. Co.
Novelty Electric Co.
Pennsylvania Electric Co.
Phenix Elec. Tel. Co.
Randall, James D.
Rawson Electric Co.
Reading Elec. Mfg. Co.
Standard Tel. & El. Co.
Sterling Electric Co
Stromberg-Carlson Tl. M. Co.
Taber & Mayer.
Thomson & Co., J. W. Jr.
Underwood Mfg. Co., H. C.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Cons. Co.
Whitman & Couch.
Wilhelm Tel. Mfg. Co.
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Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Roth Bros. & Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co
Trolley Cord.
Samson Cordage Wks.
Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.
Turbine & Water Wheels.
Am. Impulse Wheel Co.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Commercial El. Supply Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C Co
Washburn & Moen Mfg. Co.
Western Electric Co.
Woodwork, Electrical.
Cabinet Mfg. Co.
X Ray Outfits.
Commercial El. Supply Co
Edison Lamp Dept.
Queen & Co.
Swett & Lewis Co.

DIEHL

ENCLOSED ARC

LAMPS

MOST IMPROVED TYPE FOR DIRECT CURRENT CIRCUITS.
HIGHEST DEVELOPMENT IN ELECTRICAL DESIGN.

SHOWROOMS:

561-563 Broadway, New York.
192-194 Van Buren Street, Chicago.
128-132 Essex Street, Boston.

DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

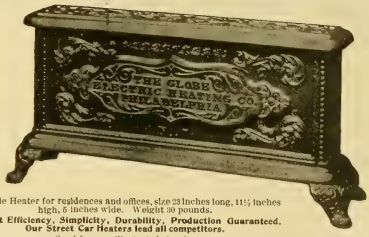
The American Electric Meter Co.,

9th St. and Montgomery Ave., Philadelphia, Pa.,

Is now prepared to take orders for early delivery of all sizes of 3-Wire Constant Potential Registering Meters.

This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
This meter is hermetically sealed.
This meter measures correctly with uneven loads.
This meter can be calibrated with a watch in six minutes.
This meter requires no lubrication.
This meter is magnetically shielded.
This meter is direct reading, having no multiplier.
This meter does not require one-thousandth of a horse power.
This meter will operate for years without opening.
This meter has no springs, jewels or frictional errors.
This meter once right is always right.

ELECTRIC HEATERS AVAILABLE TO ALL. MINIMUM EXPENSE.



Portable Heater for residences and offices, size 23 inches long, 11½ inches high, 6 inches wide. Weight 30 pounds.

Highest Efficiency, Simplicity, Durability, Production Guaranteed. Our Street Car Heaters lead all competitors.

Send for new illustrated circular.

Heating coils renewed like incandescent lamps. Constructed for any voltage. Work on direct or alternating current. Consumes 6.8 amperes on 110 volt current, 1.5 on 500 volt current.

THE GLOBE ELECTRIC HEATING CO., 147 North 12th Street, Philadelphia, Pa.

The Best System of Belting in the World

Compared with Straight Belts - - - { Easier on bearings, Smaller per cent. of slip, One-half the space.

Compared with Clutches - - - - { Less expense, More efficient in operation, Great saving in space.

Compared with Direct Coupling - { About the same floor space, Cost much smaller, Easier to keep in repair.

Write for Further Particulars.

Paper Insulated Cable.

THE ONLY

CABLE FOR HIGH TENSION SERVICE.

READ THE FOLLOWING TESTIMONIALS:

TWIN CITY RAPID TRANSIT CO.,
CONTROLLING
THE STREET RAILWAY SYSTEMS
OF
MINNEAPOLIS AND ST. PAUL.

MINNEAPOLIS, February 14th, 1898.

THE NATIONAL CONDUIT & CABLE COMPANY,
TIMES BUILDING, NEW YORK.
EDWIN REID, SUPERINTENDENT OF CONSTRUCTION.

DEAR SIR:—In accordance with our contract, your company has installed a complete conduit and cable system.

The conduits, some 120,000 duct feet, were accepted in August, 1897.

The four transmission cables, some 90,000 feet, have now been tested as per contract. They have stood the strain and tests and are hereby pronounced satisfactory.

We would call particular attention to the St. Paul cable. This cable, over nine miles long, carried 18,000 volts alternating current for over eight hours. After this test, the high potential switches were broken on 12,000 volts, when the cable was transmitting 700 horse power. These tests were very severe. New conditions were met; new methods of testing adopted and valuable data collected as to the proper handling and installation of high potential cables.

The St. Paul cable is now in regular service transmitting 2,000 H. P. nine miles by the three-phase 12,000 volt system.

Yours truly,

EDWARD P. BURCH, Electrical Engineer,
Twin City Rapid Transit Co., and the St. Anthony Falls Water Power Co.

MINNEAPOLIS MILL COMPANY
AND
ST. ANTHONY FALLS WATER POWER COMPANY,
INCORPORATED 1856.

MINNEAPOLIS, MINN., February 15th, 1898.

NATIONAL CONDUIT & CABLE COMPANY,
TIMES BUILDING, NEW YORK.

GENTLEMEN:—We hereby formally accept the four lines of your lead covered 3-conductor, paper insulated, high potential power cables, which you furnished and installed in the four cement-lined conduit ducts which were also furnished and constructed by you in this city and to St. Paul, 10¼ miles distant.

We take pleasure in testifying to the fact that the severe tests upon your cables have shown the superiority of your cable; and we have good reason to congratulate your company, as well as ourselves, upon the satisfactory results obtained.

Appreciating the broad-gauged manner in which you have carried on your work during the installation of our plant and the very satisfactory way in which you have handled all our affairs, we remain

Very respectfully,

ST. ANTHONY FALLS WATER POWER CO.,
By WM. de la BARRE, Engineer, Agent and Treasurer.

WE HAVE FURNISHED ALL THE CABLES FOR THE LACHINE RAPIDS HYDRAULIC & LAND CO., OF MONTREAL, ALSO LARGE QUANTITIES TO THE CATARACT POWER & CONDUIT CO., OF BUFFALO.

Write us for Information Regarding Cables and Conduits for Any Kind of Service.

The National Conduit & Cable Co.,

TIMES BUILDING, NEW YORK.

Rookery, Chicago, Ill. Ames Building, Boston, Mass.

"OH, PA! PA! — LOOK AT WHAT THAT AD. STUDIO MAN DID!"

Important....

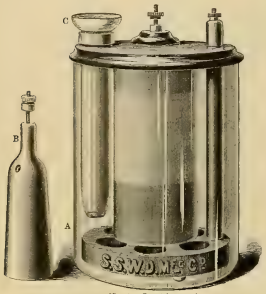
P. S. Bear in mind, we simply spoiled a good picture to impress upon you **that we carry the largest stock of Telephone Supplies** in our territory, and make the promptest shipments, as **all goods** can be shipped from **stock in St. Louis.**

P. S. We do not handle telephone instruments.

The Partz Acid Gravity Battery

PATENTED AUG. 17, 1886; DEC. 7, 1886.

For Long-Distance and Continuously Used Telephones, Electric Signals, Electric Clocks, Watchmen's Clocks, etc.



No. 3. Jar 6 in. x 8 in.

E. M. F., 1.9 to 2 volts on open circuit. PRICE OF CELL, $1.50 EACH.

Partz Sulpho-Chromic Salt.

Patented March 6, 1888.

Sulpho-Chromic Salt is, as its name indicates, a combination of sulphuric and chromic acids in an amorpho-crystalline state, the efficacy of which is attested by the superiority of the batteries based upon its use.

It was specially devised for use with the Partz Acid Gravity Batteries. Its high specific gravity causes it to sink to the bottom of the jar, where it remains, forming a dense depolarizing solution, which, unless disturbed, will not rise, and therefore does not attack the zinc, so that the battery remains for long periods on open circuit without loss of efficiency.

Sulpho-Chromic Salt, when dissolved in water, makes a standard electropoion fluid without the necessity of handling liquid acids, having practically the same amount of stored energy as an equal quantity of fluid made in the ordinary ways, giving with a zinc-carbon element an E. M. F. of 1.9 to 2 volts, and an ampere-hour capacity of about the same.

Sulpho-Chromic Salt is put up in air-tight jars with screw lid, each jar containing two pounds. As the salt is hygroscopic, it must be guarded against moisture

Price per jar, 2 lbs., - $0.75.

SEND FOR CATALOGUE.

The Partz Acid Gravity Battery combines the advantages of the gravity and Bunsen types. It is a two-fluid cell, using the elements and fluids of the Bunsen, with the gravity principle of the Callaud. Its principle is readily understood from the illustration. The carbon plate (*a*) lies on the bottom of the jar; the zinc (*b*) is suspended near the top. The jar being filled with a solution of common salt or sulphate of magnesia, Partz Sulpho-Chromic Salt is added through the funnel (*c*). This dissolves, forming a depolarizing solution, which on account of its greater density remains at the bottom, surrounding the carbon plate, and away from the zinc, constituting the second fluid, and separated from the other by gravity only.

It has a high voltage, 1.9 to 2 volts, and very little polarization, when properly used.

It furnishes a practically constant current until the fluid is completely saturated with the products of the chemical action, up to which time the addition of Sulpho-Chromic Salt through the funnel whenever the battery shows signs of weakening will **immediately restore its strength.**

When not in use it will stand for months on open circuit without appreciable waste, and always ready for instant service. The zinc, the only part that ever wears out, is only acted upon when the battery is producing current, and will last from one to four years, according to use.

Charging it is a cleanly and safe operation, because there are no liquid acids to handle. It is the cleanest, strongest, most effective, most reliable, and most economical open-circuit battery before the public.

The Following Letters Tell the Story of the Battery:

THE NEW YORK AND NEW JERSEY TELEPHONE CO.

ELIZABETH, October 5, 1893.

The S. S. White Dental Mfg. Co., 12th and Chestnut Sts., Philadelphia.

GENTLEMEN:—Yours of 3d inst. to hand and contents noted. In reply, I beg to state that we connected the Partz Batteries in circuit at our busiest long-distance subscriber's office (Borne & Scrymser Co.), at Elizabethport, N. J., on June 23, 1893. The first charge lasted until August 19. At that date we recharged the glass funnel; this charge lasted until September 19. The battery had not run down, but the red solution had nearly disappeared.

In my opinion, they are the batteries for the telephone business, especially for long distance and connections that take a great deal of time.

Borne & Scrymser Co. use their phone as long as one and one-quarter of an hour without ceasing; half an hour very often. So you see I placed the batteries where they would be subjected to a severe test. Yours respectfully,

CHARLES M. ROOT, Manager.

OFFICE OF THE NEW YORK AND NEW JERSEY TELEPHONE CO.

MANAGER'S OFFICE, ELIZABETH, July 9, 1895.

The S. S. White Dental Mfg. Co., Philadelphia.

GENTLEMEN:—Your letter of the 5th inst. to hand and contents carefully noted, and in reply I beg to say that you may add to my letter of February 26, 1895, that from February 15 to April 12 there was no attention needed; on that date we added "Kronite" or Chromic Salts. May 14 renewed batteries, and we have done nothing since.

In twenty-five months we have renewed the batteries *twice*. The zincs and carbons have never been changed. The adding of Chromic Salts every other month keeps the batteries to their work—no dirt, no trouble, and in my estimation they are the best batteries for long-distance telephoning, and especially for subscribers who use their phones often and for long connections. Yours, etc.,

CHARLES M. ROOT, Manager.

THE S. S. WHITE DENTAL MFG. CO.,

Philadelphia, New York, Boston, Chicago, Brooklyn, Atlanta, Rochester, Berlin (Germany), Buenos Ayres, R. A.

WE OFFER TO THE PUBLIC A NEW AND MARVELLOUS ELECTRIC CABLE,

As Reliable as a Galvanometer, as Infallible in Action, and Continuously Thermostatic.

Standardized in Sizes for all Interior Electric Adaptations. It is the only cable in the world combining Fire and Burglar Alarm protection with all other interior electric wiring work, in same installation. We confine ourselves to the manufacture and sale of this cable exclusively, it being auxiliary to all other electric interests.

By the use of this cable every infinitesimal part of every wire hereafter installed for whatever purpose in all buildings is made a detective point for the discovery and automatic notification of fire. We have opened up a new and rich field for the electrical contractor. If you are not acquainted with us and the cable, you should be. Write or call and become so.

Write for illustrated and descriptive printed matter.

We own the sole and exclusive right to manufacture and sell the Montauk Multiphase Cable and Central Station Controller, by virtue of the following patents: No. 546,261, Sept. 10, 1895; No. 546,262, Sept 10, 1895; No. 565,053, Aug. 4, 1896; No. 565,178, Aug. 4, 1896; No. 565,188, Aug. 4, 1896; No. 565,217, Aug. 4, 1896; No. 565,410, Aug. 4, 1896; No. 594,034, Nov. 23, 1897; No. 594,247, Nov. 23, 1897; No. 594,281, Nov. 23, 1897, which broadly cover not only the method of manufacturing, but the basic principle upon which these cables are constructed.

MONTAUK MULTIPHASE CABLE CO.

American Surety Building Rooms 9-10-11, 18th Floor. **100 Broadway, New York.**

OFFICERS.

JOHN D. GOULD, Prest. C. W. PRICE, Vice-Prest.
CHAS. A. HANSON, Treas. and Sec'y.

Telephone, 4021 Cortlandt.

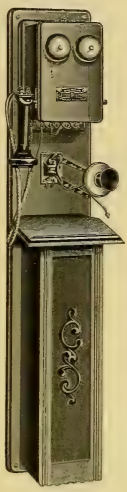
FACTORY: East 25th Street, New York.

OUR APPARATUS

Is in use in over 400 prosperous independent telephone exchanges, in the navy and war departments, by railroad companies, etc., aggregating over ....

100,000 TELEPHONES.

NO. 31.

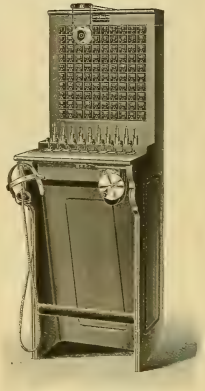


Cut shows Williams-Abbott Electric Co.'s make of Magneto Bell

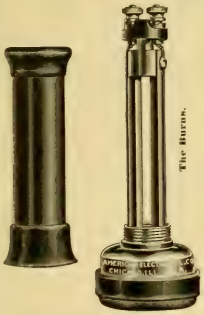
Exclusive Sale Controlled by Us.

Fully nickel plated. Equipped with our New Type Long Lever Gravity Switchhook, positive in contact. Improved Watson wiring. Outside Binding Posts.
Bell Box of proper dimensions to allow of placing coil in same if desired.

"EXPRESS" Switchboard.



Cut shows a complete 100 Drop "Express" Switchboard.



The Burns.

CUTS OF RECEIVER PARTS.

Tri-Polar Ringer Magnets, the action of which is such that the permanent magnetic plane is coincident with the electro-magnetic plane of the bobbins, and in its operation it tends to strengthen the permanent magnet. Permanent magnets are of special steel and very powerful.
Outside Binding Posts for attachment of Receiver Cord Tips and Primary and Secondary Transmitter Circuits.
Heavy Cut Gears and Automatic Shunts, Furnished in walnut or oak, in both series and bridging types.

PRICES

Standard Exchange Series Style Generators, wound to ring through 10,000 ohms, complete with switchhook	$6.00
Bridging Type, with Heavy Output Generator and Ringers, wound to a resistance of 1,600 ohms, complete with switchhook	8.00
Standard Wound Series Extension Bells	3.00
Low-ohm Bridging Extension Bells	3.00

COMBINED TRANSMITTER AND RECEIVER.

NO. 11.

OUR NEW NO. 40 DESK SET.

With Extension Bell, Hand Generator and Batteries.

ABOVE cuts show our **NEW DOUBLE POLE ADJUSTABLE RECEIVER**, embracing new and original features possessed by no other, which makes it the most perfect and reliable receiver ever placed on the market, combining sensitiveness, loud talking qualities, positiveness and ease of adjustment and accessibility of all parts for the purpose of inspection and repairs.

AMERICAN ELECTRIC TELEPHONE COMPANY,

Manufacturers of High Grade Telephone Apparatus.

"American-Hunnings" Long Distance and Exchange Series and Bridging Telephones, Switchboards and Appliances.
Associated with Laclede Carbon and Electric Co., Williams-Abbott Electric Co.

MAIN OFFICE AND FACTORY, 171-173 S. Canal St., CHICAGO, U. S. A.

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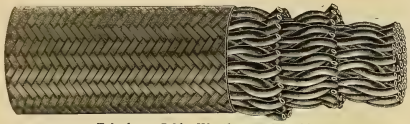

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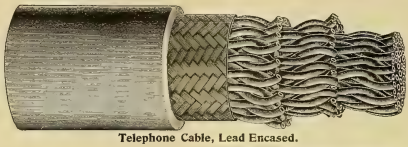

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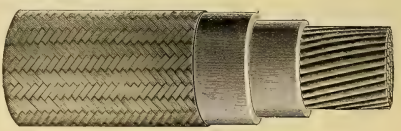

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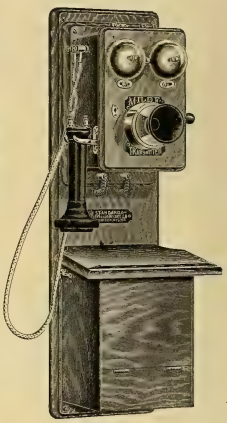

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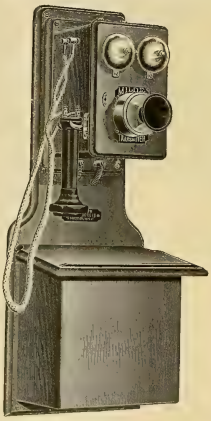

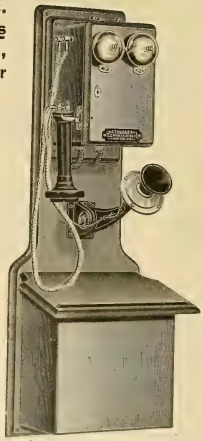

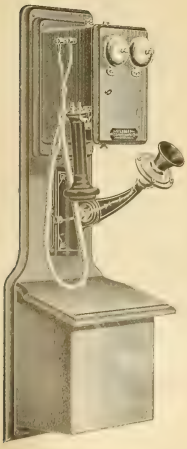

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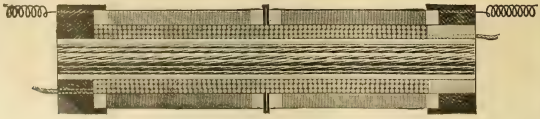

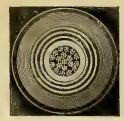

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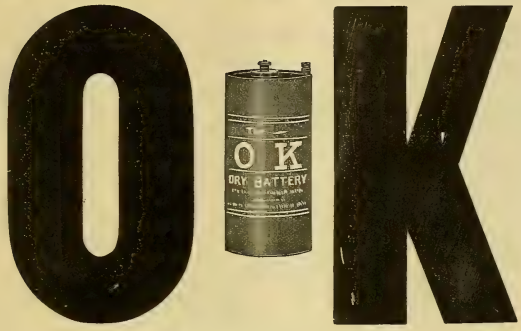

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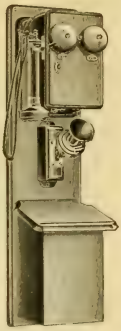

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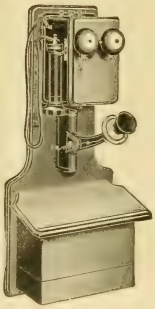

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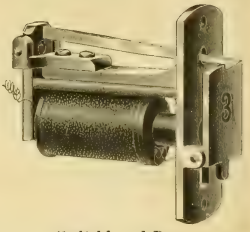

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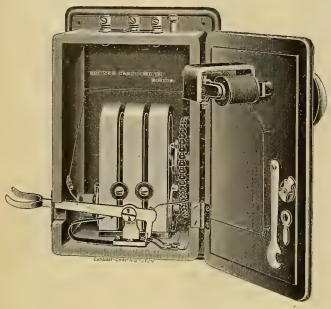

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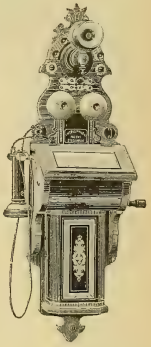

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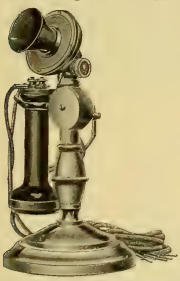

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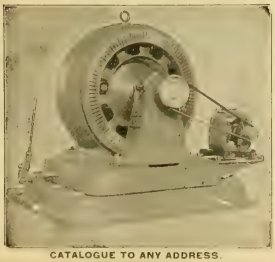

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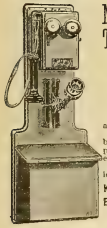

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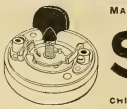

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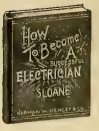

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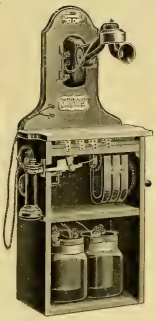

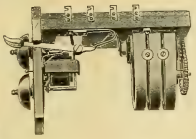

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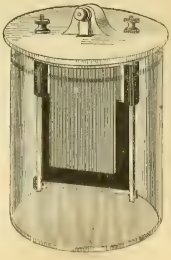

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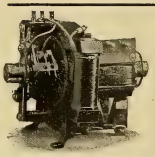

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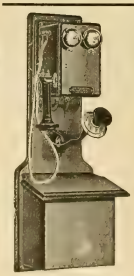

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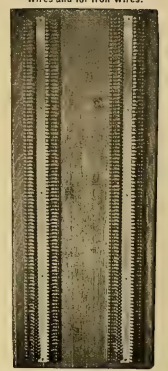

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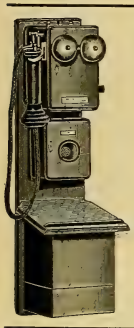

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The Honorable William J. Allen, judge of the Circuit Court of the United States at Springfield, Illinois, handed down a decision in the case of Addie F. Ide, *et al.*, Executors, *vs.* Chuse, *et al.*, on the twenty-first of December, sustaining the validity of the following patents:

No. 308,498, for Steam Engine Governors, granted November 25th, 1884, to Albert L. Ide.

No. 321,726, for Steam Engine Cross-head Lubricators, granted July 7th, 1885, to Albert L. Ide.

No. 396,209, for Engine-frames, granted January 15th, 1889, to Albert L. Ide.

No. 400,682, for Lubricating Device for Steam Engines, granted April 2nd, 1889, to Albert L. Ide.

These patents cover the governor, engine-frame, cross-head lubricator and self-oiling system which has become known to the public in connection with the "Ideal" engine. Manufacturers and users of engines embodying the features covered by these patents are notified that they will be held to account for infringement.

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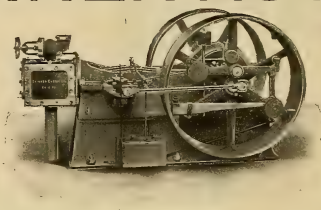

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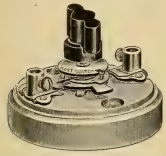

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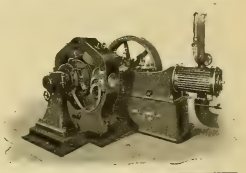

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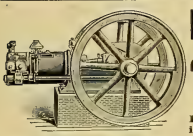

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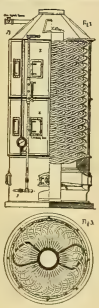

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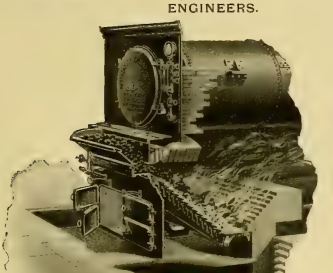

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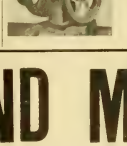

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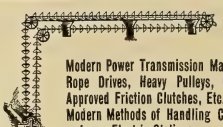

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Recent tests at Holyoke, given below, enable us to guarantee:

The Largest Power ever obtained from a wheel of the same diameter. The highest speed ever obtained for the same power. The highest mean efficiency when running from half to full gate. We guarantee also: *A runner of the greatest possible strength. A gate unequaled in quickness and ease of opening and closing.*

Test of a 45 in. SAMSON, Jan. 25, 97.

Gate Open.	Head.	Rev. Per. Min.	Cu. Ft. Per. Sec.	Horse Power.	Per Cent.
Full	15.00	144.00	172.69	240.97	89.03
¾	15.04	138.12	155.93	223.51	84.55
¾	15.11	127.67	133.24	191.06	83.68
½	15.88	131.50	112.65	164.80	80.55
½	16.47	126.87	90.04	127.73	75.95

Test of a 36 inch SAMSON, Feb. 1, '97.

Gate Open.	Head.	Rev. Per. Min.	Cu. Ft. Per. Sec.	Horse Power.	Per Cu.
Full	15.29	194.25	102.02	143.44	81.08
¾	16.56	187.75	92.15	146.73	84.78
¾	17.33	178.50	83.95	138.40	83.88
½	17.54	176.40	68.82	109.64	80.09
½	17.68	168.50	57.69	88.14	76.19

JAMES LEFFEL & CO., Springfield, Ohio, U. S. A.

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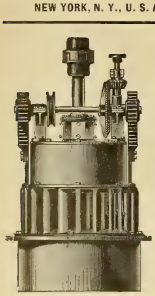

Gives more power per diameter with a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.

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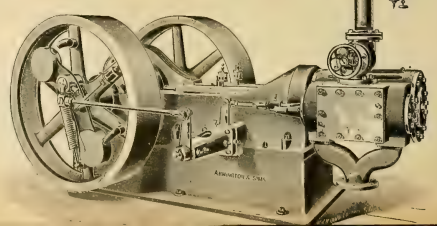
Unexcelled in Design, Workmanship, Efficiency, Regulation. Double ported, Self-Adjusting Cylindrical Valves. Absolutely Tight. Perfect Steam Distribution. Rites Inertia Governor. Simple. Powerful. Effective. Engines 25 to 2,000 H. P. Capacity, to meet the requirements of any service.



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NEW YORK, W. F. Haring, 609 Havemeyer Bldg.

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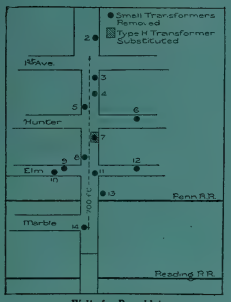
Transformer Economy No. 2.



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THE CHANGE AT CONSHOHOCKEN, PA.

Last week we showed the results of a change in transformer practice at Conshohocken, Pa., in which two Type H Transformers superseded 25 small Transformers of old make and effected a saving of 1,426 watts. In a part of the same district (diagram No. 2) one Type H Transformer superseded 14 small ones of old make.

RESULT OF THE CHANGE:

Core loss of 14 small Transformers,	886
Core loss of one Type H Transformer,	124
Saving in Watts,	**762**

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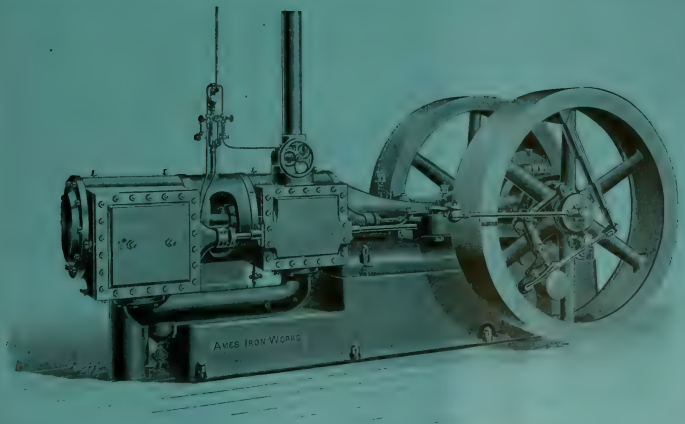

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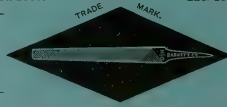

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"	"	"	" " " Twisted in Pairs.
"	"	"	Braided, Single Conductor.
"	"	"	" Twisted in Pairs.
18	.043	$\frac{46}{32}$	Plain, without Braid, Single Conductor.
"	"	"	" " " Twisted in Pairs.
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16	.140	$\frac{45}{32}$	Plain, without Braid, Single Conductor.
"	"	"	" " " Twisted in Pairs.
"	"	"	Braided, Single Conductor.
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B. & S.	Approximate Decimals.	RUBBER INSULATION.	
16	.051	$\frac{1}{32}$	Plain, without Braid, Single Conductor.
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"	"	"	" Twisted in Pairs.
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" " " " "	"	"	" Twisted in Pairs.
" " " " "	"	$\frac{1}{32}$	" Single Conductor.
" " " " "	"	"	" Twisted in Pairs.
14	.064	$\frac{2}{32}$	Plain, without Braid, Single Conductor.
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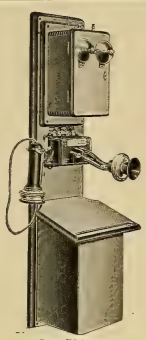

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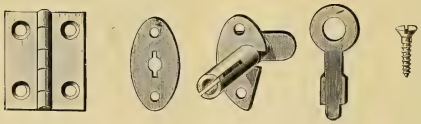

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One of our trainload shipments—twenty-two cars.

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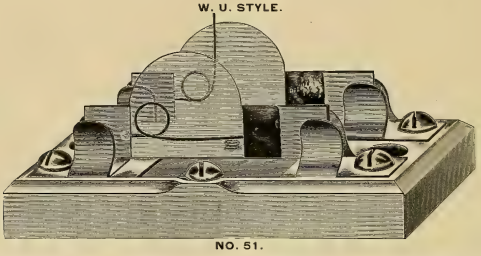

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This combination is so arranged that it forms a protection against the three dangerous currents: high-tension arc or trolley current, which forms a short circuit, the sneak current and lightning.

No. 51 is the same block which is used on the regular Maxstadt Combination Double Pole Porcelain Fusible Cut-Out Lightning Arrester. The improvement is in the Fuse.

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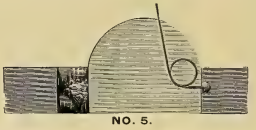

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No. 4 represents the improved Fuse when closed. No. 5 represents the Fuse when open. This Fuse is guaranteed to protect the instrument from lightning, short circuit or sneak current. It is the only combination Fuse and Fusible Cut-Out Lightning Arrester in existence to-day that will protect the 'phone against the above currents.

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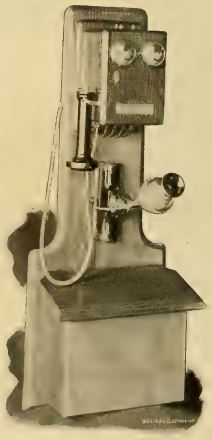

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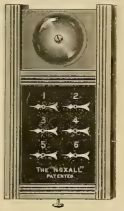
No part of the indicating mechanism back of the face-plate.

A two-piece annunciator composed of simply a magnet and needle.



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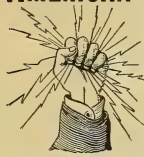

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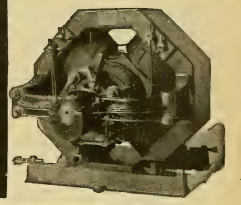

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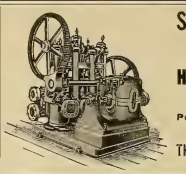
The President and Trustees of the Village of Sheboygan Falls, Wisconsin, hereby advertise under chapter 370, laws of Wisconsin, 1897, for and request the submission to them of written bids or proposals for the franchise to be granted by said President and Trustees, for the term of ten years, for the use of the streets and alleys of said village in the establishment and operation of an electric light plant and system according to the specifications containing the rules and regulations for the operation of such plant and the conduct of the same, prepared by said President and Trustees.

Said bids or proposals to state what percentage of the gross receipts from the operation of such plant the bidder will pay annually into the treasury of said village in consideration of receiving said franchise.

The said President and Trustees reserve the right to reject any or all bids.

Dated February 8, 1898.

Signed: **THE PRESIDENT AND TRUSTEES OF THE VILLAGE OF SHEBOYGAN FALLS, WIS.**



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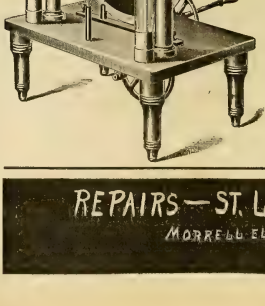

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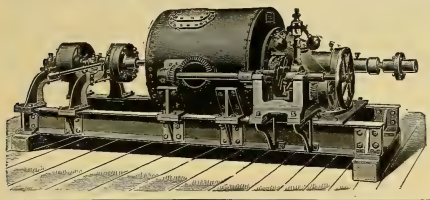

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solid back dust transmitters in Wall, Desk and Cabinet Styles. They are **Convenient, Durable** and the **best** of **talkers.**

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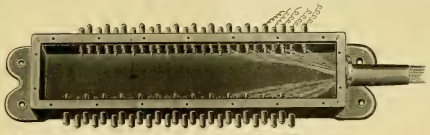

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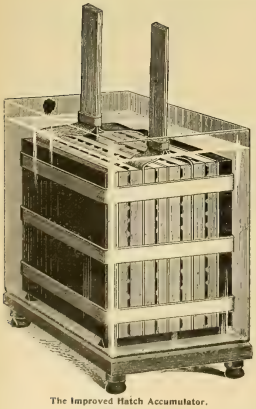

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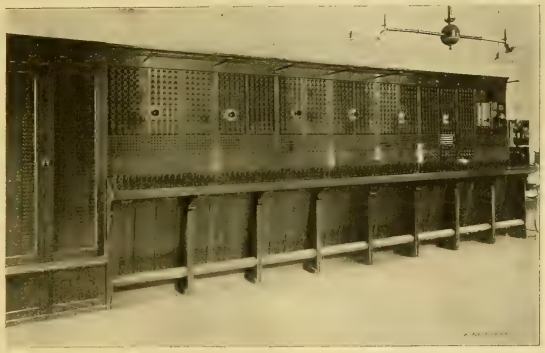

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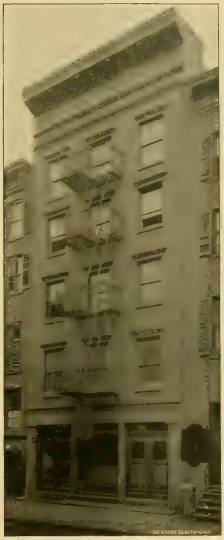

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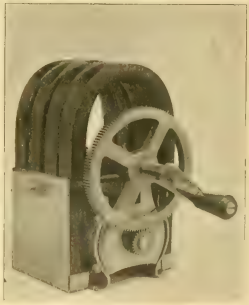

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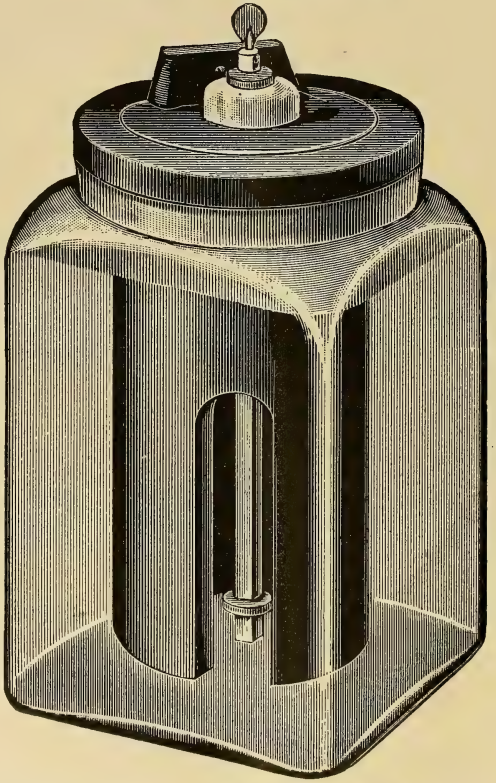

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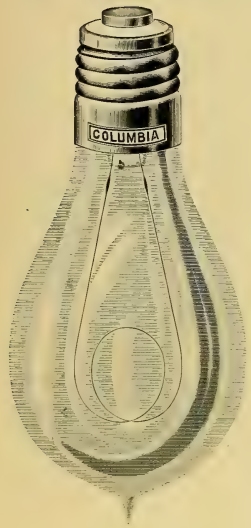

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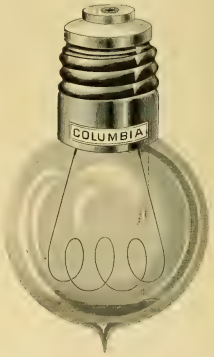

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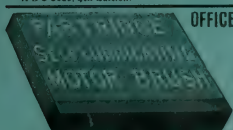

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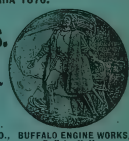

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We make no claim to wonderful inventions revolutionizing the art, or to the employment of all the lamp experts available.

Series Lamps for any service or socket. Responsible representatives wanted in large cities.

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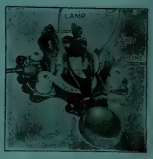
OUR "A-B" METAL HANGER BOARD IS ACKNOWLEDGED "THE BEST" ON THE MARKET.



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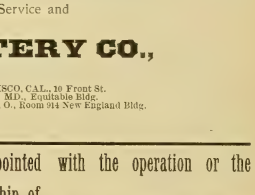

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1898

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REPAIR SHOPS

In the West. **ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION.** In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience. **NO SCRAP WIRE USED.**

CHICAGO EDISON COMPANY,

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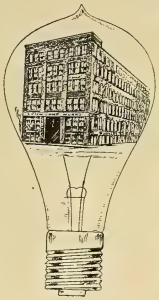
NEW AND RENEWED,

IN BARREL LOTS.



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Equally good in life, uniformity of current consumption and maintenance of candle power.

Our **NEW LYNN LAMP** is perfection in style and general construction. **Write for circulars.**

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PIONEER IN LAMP RENEWING.

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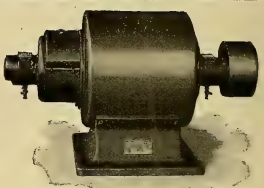

Iron-clad. Completely Closed In. Dust and Moisture Proof. No External Magnetism.

Specially Adapted for Direct Connection to Machinery.

Special Direct Current Motors for All Classes of Work.

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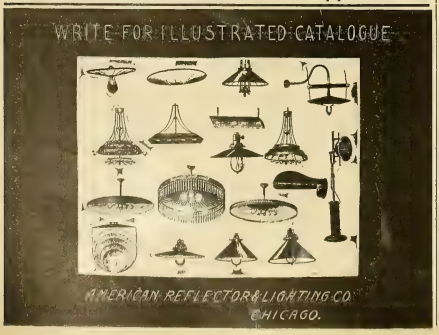
BRANCH FACTORY: Hamilton, Canada.

Cable address, Storey, Philadelphia. A B C Code used.

WALKER COMPANY,

CLEVELAND, OHIO.

The Sun Never Sets on Walker Apparatus.



Paper Insulated Cable.

THE ONLY

CABLE FOR HIGH TENSION SERVICE.

READ THE FOLLOWING TESTIMONIALS:

TWIN CITY RAPID TRANSIT CO.,
CONTROLLING
THE STREET RAILWAY SYSTEMS
OF
MINNEAPOLIS AND ST. PAUL.

MINNEAPOLIS, February 14th, 1898.

THE NATIONAL CONDUIT & CABLE COMPANY,
TIMES BUILDING, NEW YORK.
EDWIN REID, SUPERINTENDENT OF CONSTRUCTION.

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The conduits, some 120,000 duct feet, were accepted in August, 1897.

The four transmission cables, some 90,000 feet, have now been tested as per contract. They have stood the strain and tests and are hereby pronounced satisfactory.

We would call particular attention to the St. Paul cable. This cable, over nine miles long, carried 18,000 volts alternating current for over eight hours. After this test, the high potential switches were broken on 12,000 volts, when the cable was transmitting 700 horse power. These tests were very severe. New conditions were met; new methods of testing adopted and valuable data collected as to the proper handling and installation of high potential cables.

The St. Paul cable is now in regular service transmitting 2,000 H. P. nine miles by the three-phase 12,000 volt system.

Yours truly,

EDWARD P. BURCH, Electrical Engineer,
Twin City Rapid Transit Co., and the St. Anthony Falls Water Power Co.

MINNEAPOLIS MILL COMPANY
AND
ST. ANTHONY FALLS WATER POWER COMPANY,
INCORPORATED 1856.

MINNEAPOLIS, MINN., February 15th, 1898.

NATIONAL CONDUIT & CABLE COMPANY,
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GENTLEMEN:—We hereby formally accept the four lines of your lead covered 3-conductor, paper insulated, high potential power cables, which you furnished and installed in the four cement-lined conduit ducts which were also furnished and constructed by you in this city and to St. Paul, 10½ miles distant.

We take pleasure in testifying to the fact that the severe tests upon your cables have shown the superiority of your cable; and we have good reason to congratulate your company, as well as ourselves, upon the satisfactory results obtained.

Appreciating the broad-gauged manner in which you have carried on your work during the installation of our plant and the very satisfactory way in which you have handled all our affairs, we remain Very respectfully,

ST. ANTHONY FALLS WATER POWER CO.,
By WM. de la BARRE, Engineer, Agent and Treasurer.

WE HAVE FURNISHED ALL THE CABLES FOR THE LACHINE RAPIDS HYDRAULIC & LAND CO., OF MONTREAL, ALSO LARGE QUANTITIES TO THE CATARACT POWER & CONDUIT CO., OF BUFFALO.

Write us for Information Regarding Cables and Conduits for Any Kind of Service.

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TIMES BUILDING, NEW YORK.

Rookery, Chicago, Ill. **Ames Building, Boston, Mass.**

The S-W Arc Light Radiators.

BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.

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ELECTRIC MINING, LIGHTING AND POWER MACHINERY,

ALL OF

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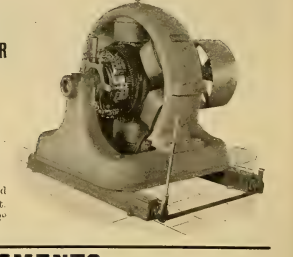

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New York Insulated Wire Co.
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Palste Co., H. T.
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Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
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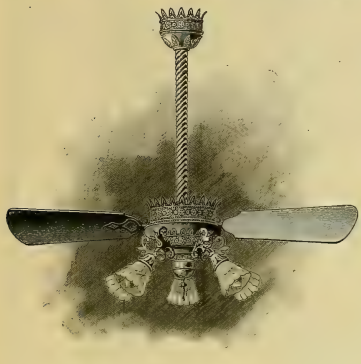
FOR ALL CIRCUITS, EXCEPT ALTERNATING.



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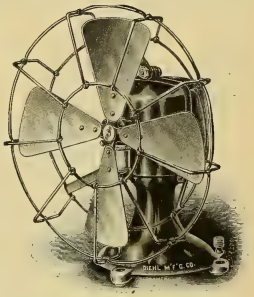

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Wound for any Voltage Direct or Alternating.

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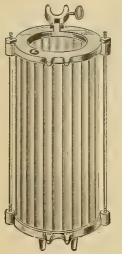

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ELECTRIC MINING, LIGHTING AND POWER MACHINERY,

ALL OF

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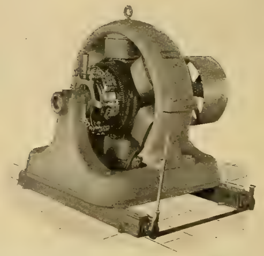

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National Cond. & Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
Junction Boxes.
Bossert Elec. Const. Co.
Lamp Adjusters.
Faries Mfg. Co.
Vought, M. I.
White Co., O. C.
Lamps, Incandescent.
Buckeye Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Edison Lamp Dept.
Electric Appliance Co.
General Electric Co.,

K. & W. Company.
Lynn Incandescent Lp. Co.
Reliable Elec. Supply Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Lightning Arresters.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.
Magnet Wire.
(See Insulated Wires.)
Mechanical Machinery.
Besly & Co., Chas. H.
Davis & Egan Mach. Tool Co.
Link-Belt Machinery Co.
Pratt & Whitney Co.
Robertson & Sons. Jas. L.
Sibley & Ware.
Stilwell-Bierce Smith-Vaile
Westinghouse, Church, Kerr & Co.
Mica.
Commercial El. Supply Co.
Munsell & Co., Eugene.
Schoonmaker, A. O.
Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.
Motors.
Akron Elec. Mfg. Co.
American Engine Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Northern Electl. Mfg. Co.
Peoples Electric Co.
Roth Bros. & Co.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wright, Wm.
Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.
Robertson & Sons, Jas. L.
Paints.
Atlantic Alcatraz Asph. Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.
Platinum.
Baker & Co.
Poles.
Berthold & Jennings.
Central Mfg Co.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pipe Company.
Perrizo & Sons.
Point Marion Mfg. Co.
Stone Lumber Co.
Torrey Cedar Co.
Valentine-Clark Co.
Porcelain.
Bryant Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.
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Shadowless Radiator Mfg. Co.
Refiners.
Goldsmith Bros.
Swarts Metal Refining Co.
Reflectors.
Amer. Reflector & Ltg. Co.
Shadowless Radiator Mfg. Co.
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Chicago Edison Co.
Hodge, Walsh & Loring.
Morrell Electric Works.
Rheostats.
American Rheostat Co.
Automatic Switch Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Leonard, Ward, Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.
Roofing.
Cincinnati Corrugating Co.

Second-Hand Machin'y.
Cornman Co.
Hine & Co., L. A.
Hodge, Walsh & Loring.
Wright, Wm.
Shades.
Amer. Reflector & Ltg. Co.
Spark Arresters.
K. & W. Company.
Speaking Tubes.
Electric Appliance Co.
Partrick, Carter & Wilkins.
Western Electric Co.
Speed Indicators.
Besly & Co., Chas. H.
Keystone El. Instrument Co.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.
Steel Boxes.
Bossert Elec. Const. Co.
Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Street Cars.
Stephenson Co., John.
Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
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American El. Telephone Co.
Bissel & Co., F.
Cabinet Mfg. Co.
Commercial El. Supply Co.
Farr Tel. & Cons. Sup. Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Lockwood T. & T. Co. of Am.
Northwest Engineering Co.
N. W. Tel. Mfg. Co.
Rawson Electric Co.
Standard Tel. & El. Co.
Sterling Electric Co
Stromberg-Carlson Tl. M. Co.
Taber & Mayer.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Cons. Co.
Transformers.
Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Roth Bros. & Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co
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Samson Cordage Wks.
Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.
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Am. Impulse Wheel Co.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
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Stilwell-Bierce Smith-Vaile.
Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Commercial El. Supply Co.
Electric Appliance Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
Western Electric Co.
Woodwork, Electrical.
Cabinet Mfg. Co.
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Edison Lamp Dept.
Queen & Co.
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For Alphabetical Index of Advertisements See Page III.

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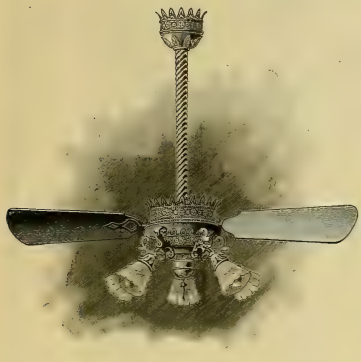
FOR ALL CIRCUITS, EXCEPT ALTERNATING.



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Recognized Standard

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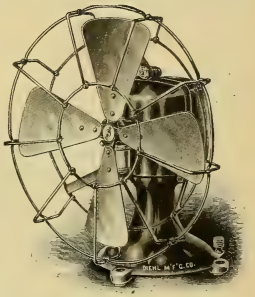
Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency

Of Any on the Market.



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Showrooms: NEW YORK: 561-563 Broadway.
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ELIZABETHPORT, N. J.

SUPPLIES (Near Home.)

Madison, Wis.
PEOPLES ELECTRIC CO.
LET US SEND YOU OUR COMPLETE
New Catalogue.

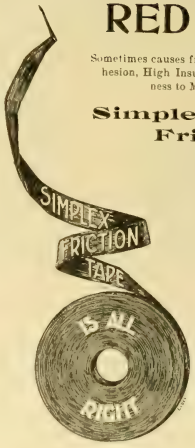
A HOT TIME | OUT OF THE QUESTION

BATES ELECTRIC FANS DO IT.

Wound for any Voltage Direct or Alternating.

D.L. BATES & BRO. DAYTON, O.

For Ceiling or Desk. A Written Guarantee with each FAN.



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Sometimes causes friction, but for Great Adhesion, High Insulation and Imperviousness to Moisture **USE**

Simplex Friction Tape.

This tape is prepared with great care of good material. A trial will convince you of its qualities. A sample roll is free for the asking. You need not purchase until you are convinced.

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CHICAGO.
NEW YORK.

Important....

P. S. Bear in mind, we simply spoiled a good picture to impress upon you **that we carry the largest stock of Telephone Supplies** in our territory, and make the promptest shipments, as **all goods** can be shipped from **stock in St. Louis.**

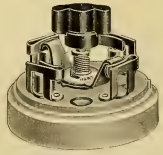
P. S. We do not handle telephone instruments.

"OH, PA! PA!—LOOK AT WHAT THAT AD STUDIO MAN DID!"

Hart Switches for 500 Volt Circuits.

No. 20½. 5 Ampere, S. P.

No. 21½. 10 Ampere, S. P.



No. 23½. 5 Ampere, 3-Way.

These switches are guaranteed to work on 500 volt circuits without causing trouble or "playing out."

No. 21½ is especially designed for electric heaters.

Continued orders from customers who have used these switches for years is convincing proof that they perform their work in a satisfactory manner.

For particulars, see our illustrated catalogue.

All switches of our manufacture are stamped "Hart Switch" on the metal.

THE HART & HEGEMAN MFG. CO., Hartford, Conn.

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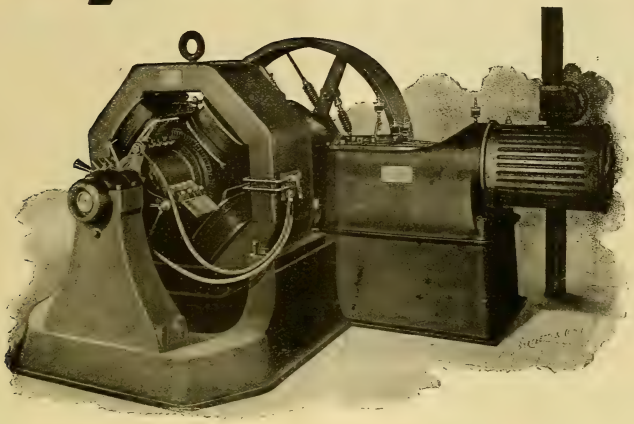

Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.

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We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

All Our Apparatus Guaranteed as Represented.

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Boston, G. M. Angier & Co., 64 Federal St.
San Francisco, Cal., California Electrical Works, 409 Market St.
Elmira, S. N. Blake.
St. Louis Western Electrical Supply Co.
Kansas City, W. T. Osborn.
Cincinnati, O., John A. Stewart.

Western Office: 204 Dearborn St., Chicago, Wallace & Hine, Western Agents.

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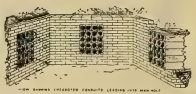
CREOSOTED WILL LAST FOR MANY YEARS.
IT PAYS TO USE THEM.
—GET OUR PRICES.—

CREOSOTED WOOD CONDUITS

FOR UNDERGROUND WIRES.

FOR TELEPHONE, TELEGRAPH AND ELECTRIC LIGHT COMPANIES.

There are advantages in using CREOSOTED WOOD CONDUITS not obtained in using any other kind; cables will not be scratched by being drawn through them; no concrete foundation, sides or top required; wires in creosoted wood conduits are most easily reached between manholes; subways constructed with creosoted wood conduits in less time than by any other. In parks and on boulevards they are the best because vegetable growth is prevented, keeping roots away from cables.



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A National Rider never changes his mount—National Cycle Mfg. Co., Bay City, Mich. Get our New Catalogue.

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Send for Catalogue.

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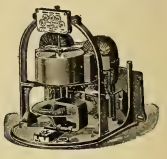
SWITCH BOARDS.
SWITCHES AND PANEL BOARDS.

TRANSFORMERS-WATTMETERS.

(SCHEEFFER'S IMPROVED.)

Double Primary Coils,
Double Secondary Coils,
Good Ventilation,
Light Weight,
High Efficiency,
Good Regulation,
Small Iron Loss,
Convenient to Install.

No Brushes,
No Commutator,
No Moving Wire,
Simplicity,
Durability,
Reliability,
Accuracy,
Even to a 6 c. p. Light.



DIAMOND ELECTRIC CO.,

MANUFACTURERS,

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THE S. K. C. SYSTEM.

A COMPLETE SYSTEM FOR

Long Distance Transmission, General Station Distribution, Mill and Factory Equipment.

Generators will be wound and guaranteed for an E. M. F. as high as

10,000 VOLTS.

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New York 39 Cortlandt St.
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St. Louis, Mo., Western Electrical Supply Co.

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BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
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Railway Feeder and Trolley Wire,
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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
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WATER-WHEEL GOVERNOR
THAT GOVERNS.

WATERVILLE & FAIRFIELD RAILWAY & LIGHT CO.,
WATERVILLE, ME., Jan. 18, 1896.

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GENTLEMEN:—In regard to your Type C governor, which is regulating for us our two Hercules Wheels, which give power to operate our Light Plant, Street R. R. and Power Generator, we are frank to admit that the machine does its work admirably. We have no hesitancy in recommending it to those in want of a governor.

(Signed)
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Electricity, Mechanics,
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Expert in patent causes.
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For Open and Closed Circuit Work.

The Perfect, Modern, Longest Lived and Most Economical Cell Ever Put on the Market.

In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM:—Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cleanest; not freezing at 28° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 250 ampere hours; for No. 2 cell, 100 ampere hours; on open circuit, .9 to 1 volt; on closed circuit, .65 to .75 volt. Send for circular and price list.

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WORCESTER, MASS.
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MAKING SOCKETS OUR SPECIALTY

Write for full particulars, free Samples, etc. We make many brands of

SOCKETS

Have saved others money. Can save you.
H. T. PAISTE CO.
CHICAGO PHILADELPHIA

Automatic Motor-Driven Starter.

Engineers and Contractors

Desiring a *thoroughly reliable* Automatic Starting Apparatus for electric pumps, elevators and other intermittent work, cannot do better than send for our catalogue of Motor-Driven Starters and Specialties. No dash-pots, shunt magnets or other delicate mechanism, yet automatic start and instantaneous release under all conditions.

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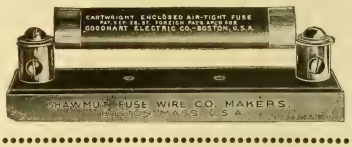
THE VARLEY DUPLEX-MAGNET CO., 188 Seventh Street, JERSEY CITY, N. J.



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MICA
Uncut Or Cut to any Size or Pattern. Washers.
SAMPLES AND QUOTATIONS FURNISHED.
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Office and Factory: PAWTUCKET, R. I.

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Immediately, traveling salesman of ability, having extensive acquaintance among electrical engineers and architects, to introduce high-class electrical goods. Liberal arrangements will be made with the right party, who must furnish the highest references. Address **F. S.**, care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

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WANTED.

Salesman to handle an up-to-date improved incandescent lamp commission in Iowa, Southern Minnesota and Wisconsin, either as a side line or full line. Liberal inducements to an energetic, reliable party. Address "**Incandescent**," care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

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ARMATURES TO REWIND.

Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.

HODGE, WALSH & LORING,
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FOR SALE.

Two automatic high-speed 9x14 simple Atlas engines, direct connected to 20-foot line shaft between them, fitted with 10 balance wheels, clutches and two pulleys for belting to dynamos or other machinery. May be seen running independently or together any day. Reason for selling—built new plant. Address **A. W. Wright, Alma, Mich.**

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One A-30 T.-H. Alternator 1,000 v. Ironclad Armature with Exciter and Switchboard, with all instruments complete. One 45 K. W. Standard Generator 500 v. Compound Wound. One 15 h.-p. 500 V Detroit Motor. One 15 h.-p. 500 V Commercial motor. One 50 light 3,200 c. p. Arc Dynamo Standard. One 30 light 1,200 c. p. Arc Dynamo Sperry. **WILLIAM WRIGHT**, 939 Monadnock Building, Chicago.

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Copper Wire and Commutator Segments, also in market for Clean Copper Scrap.

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Second hand Arc Lamps of different manufacture; good as new and thoroughly tested; also, Arc and Incandescent Dynamos and other electrical apparatus.

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All of the street railway property of the

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The wise traveler selects the Chicago, Milwaukee & St. Paul Railway.

Why?

It is the best road between Chicago and the Twin Cities.

It has the most perfect track.

Its equipment is the finest.

Its sleeping cars are palaces.

Its dining-car service is equal to the best hotels.

Its electric-lighted trains are steam heated.

Its general excellence has no equal

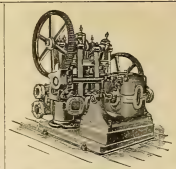
It is patronized by the best people.

It is the favorite route for ladies and children as well as for men.

It is the most popular road west of Chicago.

It gives the choice of seven trains daily.

City Ticket Office, 95 Adams St., Chicago.



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OPERATED BY ELECTRIC MOTOR.
SINGLE AND DOUBLE ACTING.

HOUSE PUMPS, ELEVATOR PUMPS,

WATER WORKS PUMPS, ETC.

ALSO

Pumping Machinery for Every Possible Duty. New Catalogue Free.

Manufactured by

THE STILWELL-BIERCE & SMITH-VAILE CO.,
DAYTON, OHIO, U. S. A.

Goldsmith Bros.,

PLATINUM REFINERS,
63 Washington Street, Chicago, Ill.
Highest Cash Price Paid for Platinum Scrap.
Platinum Wire and Plate For Sale.

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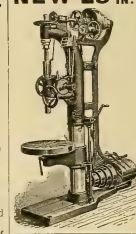

Has valuable movements for getting out work with great rapidity

Drill Book "D" shows the many qualities of this and other drills.

SIBLEY & WARE,
South Bend, Ind.

BUY YOUR BOOKS

FROM THE

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MARLO IRON BOX BELL

Is the Only Double Adjustment Bell That

Cannot Get Out Of Adjustment.

PROCTOR-RAYMOND MFG. CO.,
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Runs Two Solid Vestibuled Trains Daily

DIAMOND SPECIAL NIGHT TRAIN

DAYLIGHT SPECIAL DAY TRAIN

between Chicago and St. Louis.

Free Reclining Chair Cars, Parlor-Café Cars, Pullman Buffet Open and Compartment Sleeping Cars. See that your ticket between Chicago and St. Louis **Reads via Illinois Central Railroad.** It can be obtained of your local ticket agent.

A. H. HANSON, G. P. A., Ill. Cent. R. R., Chicago, Ill.

FOR SALE.

SECOND-HAND

Direct current dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,330, 1,610 and 2,500 lights capacity.
Alternating current dynamos of 750, 900, 1,300, and 2,000 lights capacity.
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Boilers, 100, 250, 375 and 500 h. p.
Heaters, 150 and 1,000 h. p.
Pumps, all sizes.

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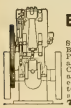

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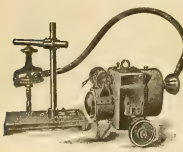

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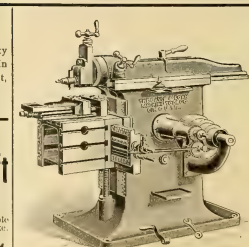

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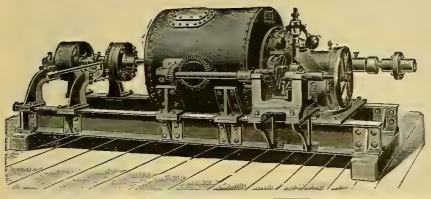

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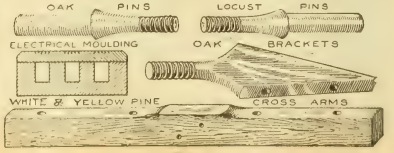

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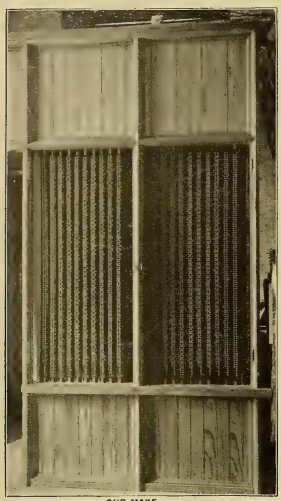

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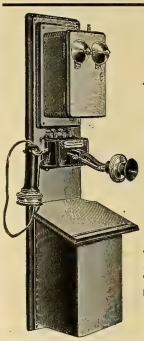

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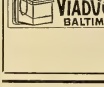

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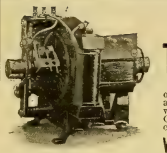

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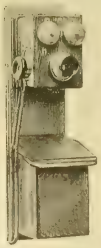

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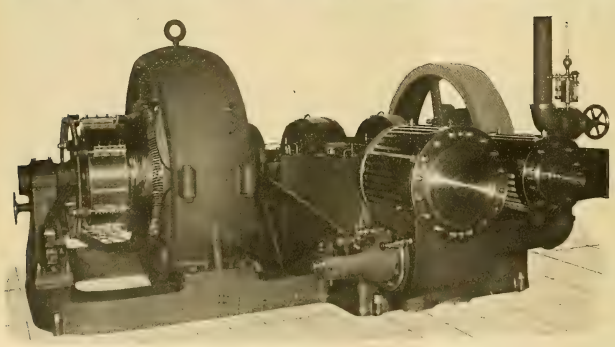

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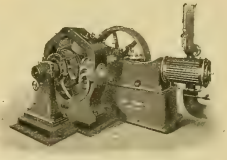

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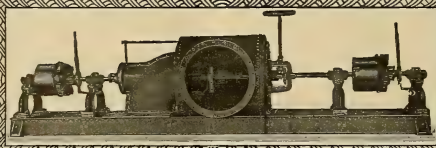

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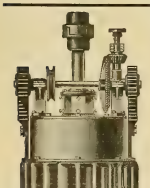

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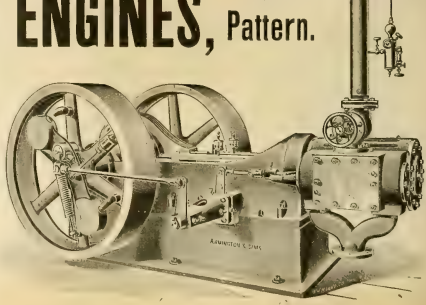

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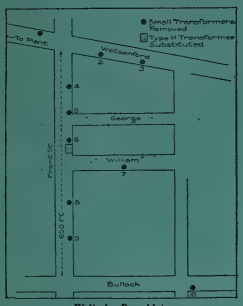

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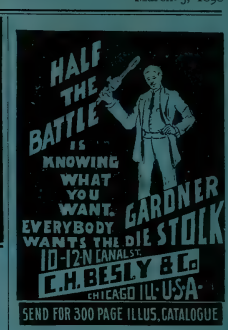

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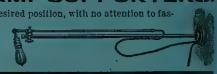

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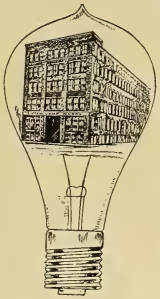

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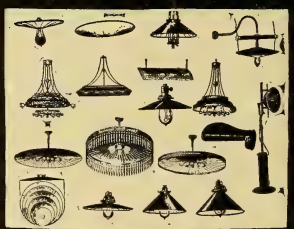

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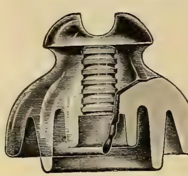

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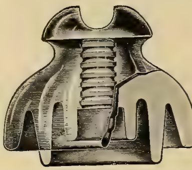

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DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

The American Electric Meter Co.,

9th St. and Montgomery Ave., Philadelphia, Pa.,

Is now prepared to take orders for early delivery of all sizes of 3-Wire Constant Potential Registering Meters.

This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
This meter is hermetically sealed.
This meter measures correctly with uneven loads.
This meter can be calibrated with a watch in six minutes.
This meter requires no lubrication.
This meter is magnetically shielded.
This meter is direct reading, having no multiplier.
This meter does not require one-thousandth of a horse power.
This meter will operate for years without opening.
This meter has no springs, jewels or frictional errors.
This meter once right is always right.

We Are Headquarters For Batteries.

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Mesco,
1900,
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Carbon,
Daniell,
Diamond,
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Gonda,
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Self-Sealing, Quick-Acting Leclanche,
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ALSO ZINCS, CARBONS, COPPERS AND SOLUTIONS AND ALL BATTERY ACCESSORIES.

WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

High-Tension, Long-Distance Transmission Underground.

OUR COMPETITORS SAID WE WOULD FAIL. READ THE TESTIMONIALS IN LAST WEEK'S PAPERS; THEN READ THE FOLLOWING:

LACHINE RAPIDS HYDRAULIC & LAND CO., Ltd.

MONTREAL, February 25, 1898.

THE NATIONAL CONDUIT & CABLE CO., Times Building, New York, U. S. A.

Dear Sirs: We have pleasure to inform you that the paper-insulated lead-covered transmission cables that you have installed for us in your cement lined ducts, as per contract, have for some time past been carrying current from our plant at Lachine Rapids through the streets of Montreal and through the subways under Lachine Canal at Seminary Street and Cote St. Paul. We have had between 4,000 and 5,000 volts on these continually, and so far have proved very satisfactory.

We might mention that the cables crossing the canal are lying in water all the time and we have had no cause to regret the selection of your cable, and trust that the present relationship between our respective companies may still continue.

Yours faithfully,

W. McLEA WALBANK, Managing Director.

WE ARE JUST AS SUCCESSFUL IN ALL KINDS OF ELECTRICAL DISTRIBUTION UNDERGROUND. WE HAVE THE LARGEST AND BEST EQUIPPED CABLE AND CONDUIT PLANT IN THE WORLD. WRITE US FOR INFORMATION.

THE NATIONAL CONDUIT AND CABLE COMPANY,

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WALKER COMPANY,

ELECTRIC MACHINERY.

WHY DOES

The Sun Never Set on Walker Apparatus?

BECAUSE

Wherever daylight is, there you will find Walker Machinery.

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Curiosity about what ? About that Special Lined Armorite Tubing for Chemical Works, mines and similar service.
Have you seen it ?

SEND FOR SAMPLE.

Any child can see the point!

It's so simple!

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OUR SPECIALTY.
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The new installment plan of The International Correspondence Schools, Scranton, Pa.—the largest and most successful institution teaching technical subjects by mail—places an education within the reach of all. Students may enroll upon paying $2 in advance, the balance to be paid at the rate of $2 a month. The charges are moderate and include all necessary text-books. Studies are carried on at home without loss of time from work.

The Electrical Power and Lighting Scholarship is a thorough course of instruction in the installation, care and operation of electric light, power and railway plants designed to meet the wants of busy men who wish to put into actual practice as soon as possible the information they acquire.

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Also 42 courses including Steam Engineering, Mechanical Drawing, Machine Design, Civil Engineering, Bookkeeping, Shorthand and English branches.

Write for circular, stating subject in which you are interested.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, BOX 1002, SCRANTON, PA.

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New Alternating Enclosed Arc Lamp

ANY FREQUENCY.

Same Method of Trim as the Standard D. C. Lamps.

ARC LAMP SALES DEPARTMENT

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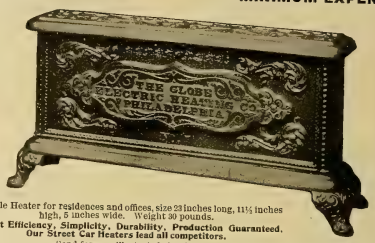
ELECTRIC HEATERS AVAILABLE TO ALL. MINIMUM EXPENSE.



Portable Heater for residences and offices, size 23 inches long, 11½ inches high, 8 inches wide. Weight 30 pounds.

Highest Efficiency, Simplicity, Durability, Production Guaranteed. Our Street Car Heaters lead all competitors.

Send for new illustrated circular.

Heating coils renewed like incandescent lamps. Constructed for any voltage. Work on direct or alternating current. Consumes 6. 8 amperes on 110 volt current, 1. 5 on 500 volt current.

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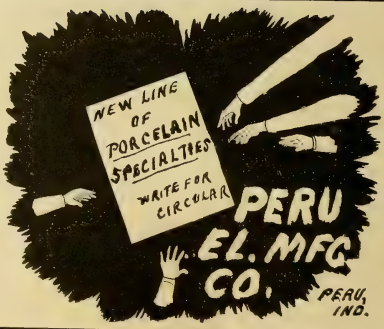

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Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights.

It Is Positive in Its Action.

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Approved by the National Fire Underwriters' Association

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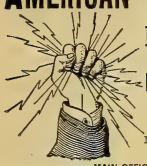

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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire.
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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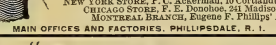
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

THE "CLARK" WIRE.

FOR SWITCHBOARD, RAILWAY and MOTOR USE.



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Inspector Boston Fire Underwriters' Union says:
"A thoroughly reliable and desirable wire in every respect."

The Clark wire has been before the public and in use for the past ten years, and has met with universal favor. We guarantee our insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class insulated wire. We shall be pleased to mail Catalogues, with terms and discounts for quantities.

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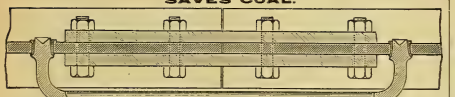

A contact which is seven times the section of the rail and **perfect.** You can twist off the wire, but you cannot **loosen the contact.** Send for samples and for further information to

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For Open and Closed Circuit Work.

The Perfect, Modern, Longest Lived and Most Economical Cell Ever Put on the Market.

In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM:—Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cheapest; not freezing at 0° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 250 ampere hours; for No. 2 cell, 100 ampere hours; on open circuit, .9 to 1 volt; on closed circuit, .65 to .75 volt. Send for circular and price list.

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EVERYTHING IN WIRE.

BARE AND INSULATED.

ALSO MANUFACTURERS OF THE "CHICAGO" RAIL BOND.

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IN DESIGN IS NOT THE ONLY IMPORTANT FEATURE OF THE ROTH HIGH GRADE DYNAMOS & MOTORS. THEY HAVE MANY OTHER FEATURES WHICH CONVINCE BUYERS OF THEIR SUPERIORITY LET US SEND YOU FURTHER PARTICULARS.

HIGH GRADE MULTIPOLAR & BIPOLAR DYNAMOS & MOTORS SLOW & MEDIUM SPEED

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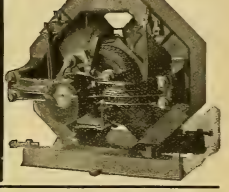

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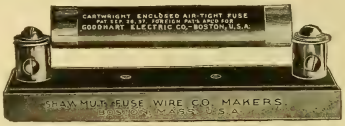
Telephone Induction Coils, Ringer and Bridge Bell Magnets, Drop Magnets, etc. Also *Gas Lighting Spark Coils.* THE VARLEY DUPLEX MAGNET CO., 138 Seventh St., Jersey City, N. J.

Automatic Motor-Driven Starter.

Engineers and Contractors

Desiring a ***thoroughly reliable*** Automatic Starting Apparatus for electric pumps, elevators and other intermittent work, cannot do better than send for our catalogue of Motor-Driven Starters and Specialties. No dash-pots, shunt magnets or other delicate mechanism, yet automatic start and instantaneous release under all conditions.

Automatic Switch Co., Baltimore, Md.



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Uncut Or Cut to any Size or Pattern. Washers.

SAMPLES AND QUOTATIONS FURNISHED.

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WEATHERPROOF WIRE.

COMPLETE STOCK CARRIED BY

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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

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Immediately, traveling salesman of ability, having extensive acquaintance among electrical engineers and architects, to introduce high-class electrical goods. Liberal arrangements will be made with the right party, who must furnish the highest references. Address **P. S.,** care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

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A good armature winder and general repair man. Steady work. State references and wages wanted. Address "E.," care WESTERN ELECTRICIAN, 510 Marquette Building, Chicago.

POSITION WANTED.

By young man 30 years of age, as superintendent of electric light plant or electric street railway. Has had 10 years' experience as superintendent. At present superintendent of electric light plant in the East. Wishes to make a change. Understands all systems. Best of references from present and past employers. Correspondence solicited. Address "K.," care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

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ARMATURES TO REWIND.

Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.
HODGE, WALSH & LORING,
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First-class, established, paying contract'ng and supply business for sale; about $4,000. Best city in Minnesota. Ill health cause. Good chance; will pay to investigate. Address **"B."** care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

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Best prices paid for scrap copper wire and commutator segments. Red brass wanted.
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Second hand Arc Lamps of different manufacture: good as new and thoroughly tested; also, Arc and Incandescent Dynamos and other electrical apparatus.
Always in the market for scrap Dynamos, Motors, Wire, Copper, burned out Incandescent Lamps and Lamp bases, etc. Address **THE CORNMAN COMPANY,** 1134 Hamilton St., Cleveland, Ohio.

For Sale—At Receiver's Sale,

All of the street railway property of the
DEFIANCE LIGHT & RAILWAY COMPANY.
A splendid opportunity for interurban extension. For particulars address
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FOR SALE

A complete street lighting plant to operate 250 24 c. p. series incandescent lamps, consisting of one 12x12 Ideal engine, nearly new; one I. B. Davis pump, No. 2; one Berryman heater, 150 h. p.; two Mather series-wound dynamos, capacity 125 24 c. p. lamps each, together with shafting, pulleys, switchboards, etc., will be sold in whole or in part; also two 125 h. p. Westinghouse automatic engines, in use less than a year; one 75 h. p. Westinghouse Junior engine, in use less than a year; one horizontal 14x42 Corliss, 75 h. p., in good order. The above will be sold at a bargain, as the company have no further use for same. Address

THE MANCHESTER LIGHT & POWER CO.,
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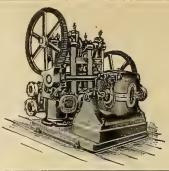

SMITH-VAILE TRIPLEX PUMPS.

OPERATED BY ELECTRIC MOTOR.
SINGLE AND DOUBLE ACTING.

HOUSE PUMPS, ELEVATOR PUMPS,

WATER WORKS PUMPS, ETC.
ALSO
Pumping Machinery for Every Possible Duty. New Catalogue Free.
Manufactured by
THE STILWELL-BIERCE & SMITH-VAILE CO.,
DAYTON, OHIO, U. S. A.

Goldsmith Bros.,
PLATINUM REFINERS,

63 Washington Street, Chicago, Ill.
Highest Cash Price Paid for Platinum Scrap.
Platinum Wire and Plate For Sale.

NEW 23 IN. DRILL.

Has valuable movements for getting out work with great rapidity

Drill Rook "D" shows the many qualities of this and other drills.

SIBLEY & WARE,
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FROM THE
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MARLO IRON BOX BELL

Is the Only Double Adjustment Bell That

Cannot Get Out Of Adjustment.

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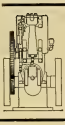
For Sale Cheap.

One A-30 T.-H. Alternator 1,000 v. Ironclad Armature with Exciter and Switchboard, with all instruments complete. One 40 K. W. Standard Generator 500 v. Compound Wound. One 15 h.-p. 500 V Detroit motor. One 15 h.-p. 500 V Commercial motor. One 50 light 1,200 c. p. Arc Dynamo Standard. One 50 light 1,200 c. p. Arc Dynamo Sperry. WILLIAM WRIGHT, 309 Monadnock-Building, Chicago.

PROUTY
Electro-Gasoline Engine



2 to 60 H. P.
Runs without smoke, odor or noise. Specially adapted to Electric Lighting, Boats, Mining Locomotives, Hoists, Portable, Threshing, Pumping, Farm and Dairies, Inspection and Street Cars, Road-Wagons, Printing Offices and all stationary purposes. All engines guaranteed and may be returned at our expense if not as represented. **THE PROUTY CO., 79 Dearborn St.,** CHICAGO, U.S.A.

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SECOND-HAND

Direct current dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,330, 1,610 and 2,500 lights capacity.
Alternating current dynamos of 750, 900, 1,300, and 2,000 lights capacity.
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Heaters, 150 and 1,000 h. p.
Pumps, all sizes.

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Two automatic high-speed 9x14 simple Atlas engines, direct connected to 36-foot line shaft between them, fitted with balance wheels, clutches and two pulleys for belting to dynamos or other machinery. May be seen running independently or together any day. Reason for selling, built new plant. Address **A. W. Wright,** Alma, Mich.

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Scrap and Native Platinum Purchased.
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Second-Hand Engines.

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MORRELL ELECTRIC WORKS,
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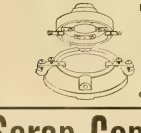
Write for full particulars, free Samples, etc.
Cleat-Concealed-Combination-Sq. Base



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Investigate—$6 saved is interest on $100.
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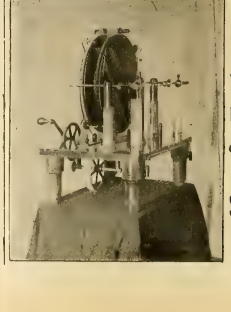
OF ALL SIZES.



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—AND—

FLUOROSCOPES

Of Our Own Make.

Glass or Rubber Plates for All Machines.

Send stamp for Catalogue No. 4.

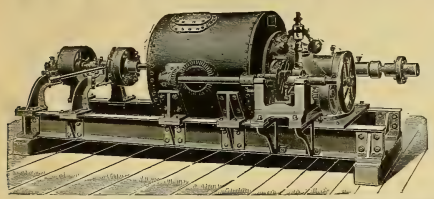
SWETT & LEWIS CO.,
11 Bromfield St.,
BOSTON, MASS.

Scrap Copper Wire Wanted.

If you have any **Old Copper Wire** of any description to dispose of, it will pay you to communicate with us, as we are at all times in the market for any quantity of **Scrap Copper Wire,** at the highest market values. We pay cash and send prompt returns. We are also supplying the electrical trade with our high grade **Babbitt, Cotton Waste, Solder, Etc.** Please communicate with us.

WARTS METAL REFINING CO.,
20 N. Desplaines Street, CHICAGO, ILL.

Victor Turbine Water Wheel.



Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double the power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

SEND FOR CATALOGUE AND PARTICULARS.

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts and where the situation admits of their use we recommend them.

THE STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, OHIO.

The Standard Open Circuit Batteries of the World.

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In Going to St. Paul and Minneapolis

The wise traveler selects the Chicago, Milwaukee & St. Paul Railway.

Why?

It is the best road between Chicago and the Twin Cities

It has the most perfect track

Its equipment is the finest.

Its sleeping cars are palaces.

Its dining-car service is equal to the best hotels.

Its electric-lighted trains are steam heated.

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It is the favorite route for ladies and children as well as for men.

It is the most popular road west of Chicago.

It gives the choice of seven trains daily.

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Telephone Men!

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Wholesale Producers.
PERRIZO & SONS, DAGGETT, MICH.

CEDAR POLES

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WHOLESALE PRODUCERS.

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TORREY CEDAR CO.,
CLINTONVILLE, WIS.
Large Stock Constantly on Hand.

POLES AND CROSSARMS

BERTHOLD & JENNINGS,
CHEMICAL BUILDING, ST. LOUIS.

THEY STILL USE IT.

Stover Bicycle Manufacturing Co.

FREEPORT, ILL., March 2nd, 1897.

IT COSTS SO LITTLE AND WORKS SO WELL

The Boiler Expurgator Co., Chicago, Ill.

Gentlemen:—I have just used your Boiler Expurgator with astonishing results. To begin with I have always been very sceptical in regard to the different boiler compounds and would never have tried yours had not a friend of mine who runs between Dubuque and Chicago on the Illinois Central induced me to use it, telling me of the results he had obtained on his locomotive. It goes beyond anything I ever tried and we have tried numerous compounds, and I can conscientiously say that I never expected to secure anything that would do the work of your Boiler Expurgator. We cheerfully recommend it to anyone and you may refer to us at any time. Very truly yours,

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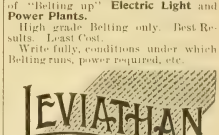

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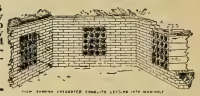

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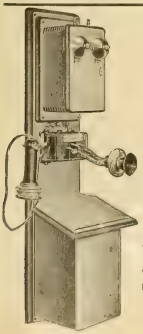

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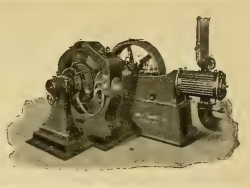

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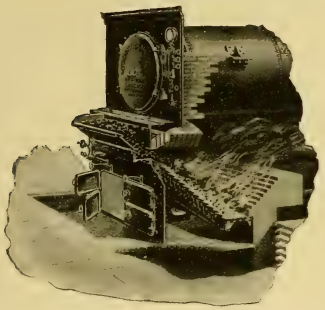

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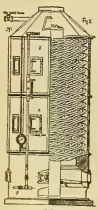

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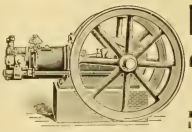

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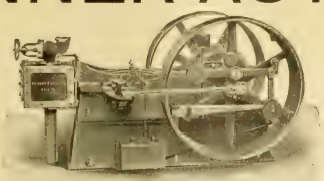

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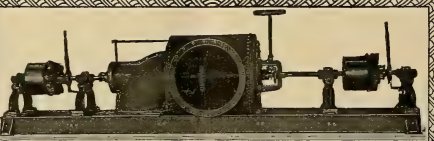

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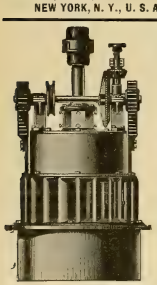

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¾	15.11	127.67	133.24	302.06	85.68	½	17.33	178.50	81.93	138.40	83.88
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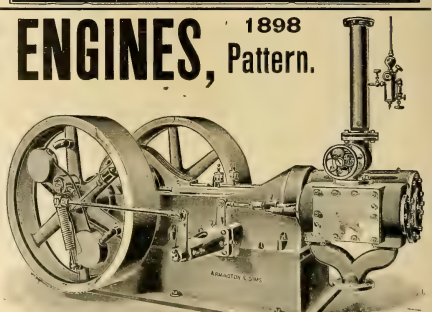

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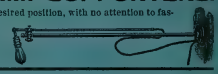

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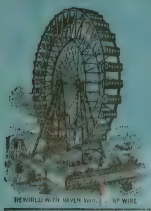
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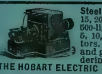

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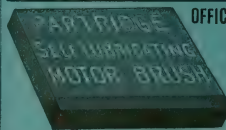

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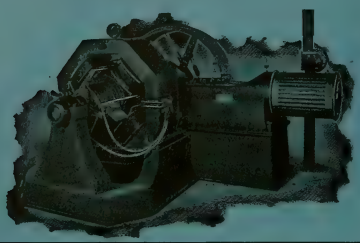

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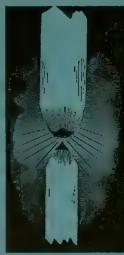

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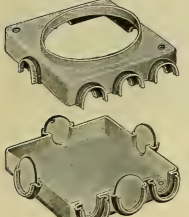

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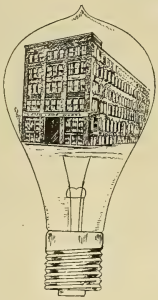

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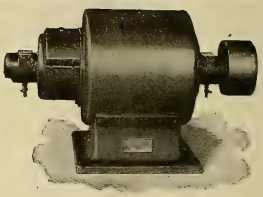

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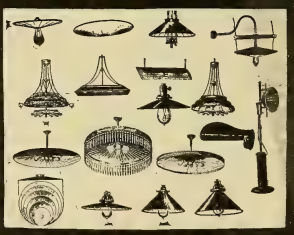

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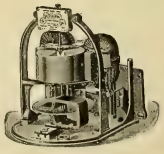

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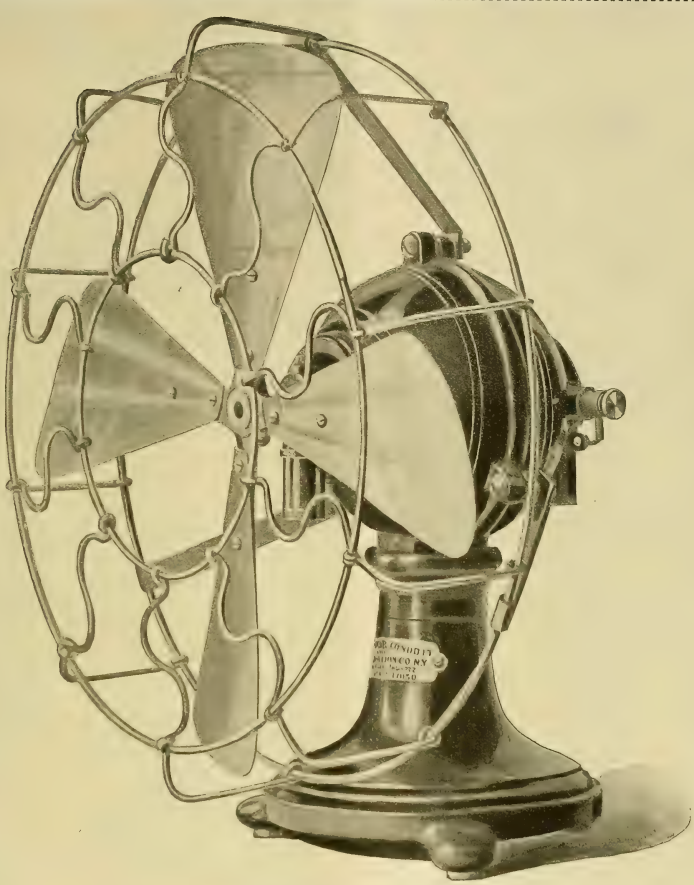

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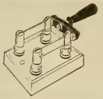

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General Electric Co.
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New York Ins. Wire Co.
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Partridge Carbon Co
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Schiff, Jordan & Co.

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Wagner Elec. Mfg. Co.
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Michigan Pipe Co.

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Peoples Electric Co.
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Electric Appliance Co.
Electric Ry. Equipment Co.
General Electric Co.
Hodge, Walsh & Loring.
Hill, W. S. Electric Co.
K. & W. Company.
Paiste Co., H. T.
Partrick, Carter & Wilkins.
Peoples Electric Co.
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Queen & Co.

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Brixey, W. R.
Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Kartavert Mfg. Co.
K. & W. Company.
Locke, Fred. M.
Mass. Chemical Co.
Mica Insulator Co.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co
Wagner Elec. Mfg. Co.
Western Electric Co.

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Brixey, W. R.
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Chicago Ins. Wire Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Montauk Multiph. Cable Co
Moore, Alfred F.
National Cond. & Cable Co
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
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Junction Boxes.
Bossert Elec. Const. Co.

Lamp Adjusters.
Farics Mfg. Co.
Vought, M. I.
White Co., O. C.

Lamps, Incandescent.
Buckeye Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Edison Lamp Dept.
Electric Appliance Co.
General Electric Co.,
K. & W. Company.
Lynn Incandescent Lp. Co.
Reliable Elec. Supply Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

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Davis & Egan Mach. Tool Co.
Link-Belt Machinery Co.
Pratt & Whitney Co.
Robertson & Sons. Jas. L.
Sibley & Ware.
Stilwell-Bierce Smith-Vaile
Westinghouse, Church, Kerr & Co.

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General Electric Co.
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American Engine Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation
General Electric Co.
Hobart Elec. Mfg. Co.
Northern Electl. Mfg. Co.
Peoples Electric Co.
Sargent & Lundy.
Sprague Electric Co.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
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Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.
Robertson & Sons, Jas. L.

Paints.
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Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd

Platinum.
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Electric Ry. Equipment Co
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Michigan Pipe Company.
Perrizo & Sons.
Stone Lumber Co.
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Valentine-Clark Co.

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Shadowless Radiator Mfg. Co.

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Goldsmith Bros.
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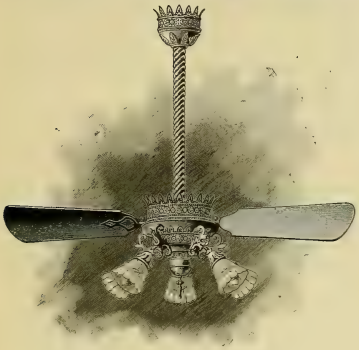
FOR ALL CIRCUITS, EXCEPT ALTERNATING.



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Recognized Standard
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Our Desk and Bracket Fans are Built of the Finest Material and are the

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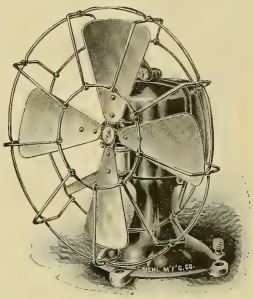

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ELIZABETHPORT, N. J.

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AKRON, OHIO,

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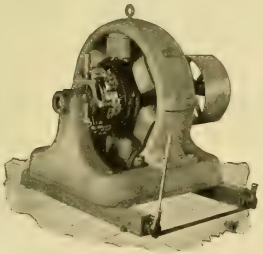
ELECTRIC MINING, LIGHTING AND POWER MACHINERY,

ALL OF

THE HIGHEST GRADE.



Write for circulars and read our guarantee of 25 per cent. continuous overload, with 52° rise in temperature.

A HOT TIME OUT OF THE QUESTION

BATES ELECTRIC FANS DO IT.

Wound for any Voltage Direct or Alternating.

For Ceiling or Desk. A Written Guarantee with each FAN.

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We Are Headquarters For Batteries.

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Law,
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National Lockwood,
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Samson,
Self-Sealing, Quick-Acting Leclanche,
Smee,
Standard Fuller,
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ALSO ZINCS, CARBONS, COPPERS AND SOLUTIONS AND ALL BATTERY ACCESSORIES.

WESTERN ELECTRIC COMPANY,
CHICAGO. NEW YORK.

High-Tension, Long-Distance Transmission Underground.

OUR COMPETITORS SAID WE WOULD FAIL. READ THE TESTIMONIALS IN LAST WEEK'S PAPERS; THEN READ THE FOLLOWING:

LACHINE RAPIDS HYDRAULIC & LAND CO., Ltd.

MONTREAL, February 25, 1898.

THE NATIONAL CONDUIT & CABLE CO., Times Building, New York, U. S. A.

Dear Sirs: We have pleasure to inform you that the paper-insulated lead-covered transmission cables that you have installed for us in your cement lined ducts, as per contract, have for some time past been carrying current from our plant at Lachine Rapids through the streets of Montreal and through the subways under Lachine Canal at Seminary Street and Cote St. Paul. We have had between 4,000 and 5,000 volts on these continually, and so far have proved very satisfactory.

We might mention that the cables crossing the canal are lying in water all the time and we have had no cause to regret the selection of your cable, and trust that the present relationship between our respective companies may still continue.

Yours faithfully,

W. McLEA WALBANK, Managing Director.

WE ARE JUST AS SUCCESSFUL IN ALL KINDS OF ELECTRICAL DISTRIBUTION UNDERGROUND. WE HAVE THE LARGEST AND BEST EQUIPPED CABLE AND CONDUIT PLANT IN THE WORLD. WRITE US FOR INFORMATION.

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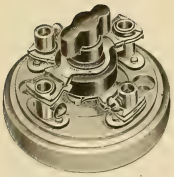
"ROOKERY," CHICAGO. **TIMES BUILDING, NEW YORK.** AMES BUILDING, BOSTON.

The Words "Hart Switch" Represent Profit to You!



Hart Switch, 10 Amp. d. p.

ALL Hart Switches have the words "Hart Switch" stamped in the metal, and this stamp is a guarantee against loss and annoyance on account of defective switches. A little probing into facts on your part will convince you that Hart Switches are the cheapest. For instance:—

How many snap switches did you buy during 1897?
How many of these were used to replace defective switches?
How many of these defective switches were stamped "Hart Switch"?
How many of the defective switches were other makes?

Hart Switches are made for active service. They are durable. You don't find them on bargain counters or in scrap heaps. It will pay you to specify Hart Switches when ordering and to make sure that you get them. Inferior switches are frequently substituted when Hart Switches are asked for.

CATALOGUE ON APPLICATION.

THE HART & HEGEMAN MFG. CO.,

HARTFORD, CONN.

REASON! WHY THE WILLARD STORAGE BATTERY IS SUPERIOR TO ALL OTHERS:

With apologies to the manufacturers of other storage batteries than the Willard, and with no desire or intention of detracting from the worth of any battery, we call attention to the construction of the Willard and invite comparison between its construction and that of others, feeling that the advantages of the Willard must be most apparent.

The Willard Plate is made of pure rolled lead sheets, from either side of which are raised at an angle of about 45 degrees thin leaves about 1-32 inch thick and about ¾ inch wide, leaving a solid sheet of lead 1-16 inch thick the full size of the plate, to which the leaves on either side are each and every one attached by the original contact the full length of the plate. The openings between the leaves are filled with peroxide of lead by electro-chemical formation.

We claim that this construction overcomes all of the faults possessed by other plates made in the past. You know the faults of the past are legion. Recall them one by one and apply them to the Willard plate and observe how completely they are overcome. Possibly the greatest advantage of the Willard plate over all other designs of plate lies in its provision for expansion. As the active material expands the thin leaves are opened, thus making the plate thicker to whatever degree the active material expands. You know how universally this failure to provide for expansion exists in other plates and also the dire consequences of the same. In fact, this is a great factor in extending the life of the Willard far beyond that of other plates. While the expansion in other plates is busily engaged in forcing the active material out of the recesses that hold it, breaking the grid, bending the plates, tearing away the heavy horizontal shelves that confine it or shattering to atoms the porcelain or metal receptacles that encompass it, the Willard Plate, free from this multitude of troubles, pursues the even tenor of a long useful life, giving daily its original capacity until, as we verily believe, it has several times outlived its neighbors. In fact, from exhaustive experiments we have made and from the condition of the plates that have been in use two, three, four and five years we can hardly imagine where the end will be. We will be pleased to hear any criticism that can be made as to the construction of the Willard Plate, as in the presentation of the Willard Plate we have yet to find an objection that can be successfully urged against it. But hold—a competitor urges that the Willard Plate is not sufficiently strong. But the answer to this is the scientific fact that the ultimate tensile strength of a cross section of our smallest plate—5 in. × 7 in.—is 625 pounds, while the weight of the plate is but three pounds. Our larger plates are of course of corresponding strength.

Remember, we stand ready to furnish for test purposes a cell of any size at one-half our lowest net price.

MANUFACTURED BY **SIPE & SIGLER, Cleveland, Ohio, U. S. A.**

REWIRED WITH RAVEN WHITE CORE WIRE

—OFFICE—
The Ferris Wheel Co.
1131 THE ROOKERY,
CHICAGO, April 30, 1896.
NEW YORK INSULATED WIRE CO.,
320 Dearborn St., Chicago Ill.

GENTLEMEN:—After carefully considering the merits of the various brands of wire upon the market, we have decided to use your "Raven White Core" exclusively for rewiring the Ferris Wheel.

As you are aware, the wire upon the wheel is very much exposed and the test will no doubt be a most severe one.

Yours very truly,
THE FERRIS WHEEL CO.
By L. V. Rice, Mgr.

GRIMSHAW WHITE CORE. Used exclusively for all Incandescent Lighting at World's Columbian Exposition.

RAVEN WHITE CORE. Used in some of the largest buildings in the United States.

COMPETITION LINE WIRE. Used by some of the largest Central Stations and Fire and Police Departments in the U. S.

GRIMSHAW TAPES, COMPETITION TAPES AND SPLICING COMPOUND.

New York Insulated Wire Company,

MAIN OFFICE: 13-17 Cortlandt St., New York. BRANCHES: CHICAGO: 320 Dearborn St. BOSTON: 134 Congress St. SAN FRANCISCO: 115 New Montgomery St.

BADT HERMETIC CELL.

TRADE MARK.

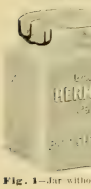


Fig. 1—Jar without cover.

EXPENSIVE in First Cost, BUT CHEAP in the Long Run.

U. S. PATENT FEB. 9, 1897. (OTHER PATENTS APPLIED FOR.)

AN AIR-TIGHT Open-Circuit Cell with Oil Seal and with Oil Insulation.

No evaporation, no creeping of salts, no leakage of electricity, no premature disintegration of zincs, no trouble of any kind, no attention, no attendance, no repair bills.

It is the **best Open-Circuit Battery** for domestic, telephone and similar purposes ever offered.

It will save its first cost in a short time, by making **inspection, attendance** and **repairs** unnecessary.

With pure materials the cell will remain operative until the last fragment of zinc is dissolved. Under **average** conditions the cell will give **at least four years' service, without the necessity of ever touching it.**

THE HERMETIC CELL is constructed on correct scientific principles and is the result of long practical experience.

PRICES:

Cell No. 1, complete.....$1.25 | Cell No. 2, complete.....$1.00

Subject to discount according to quantity contracted for. Liberal discount to the trade.

For description see reading columns of this issue.

For circulars, discounts and any further information write to

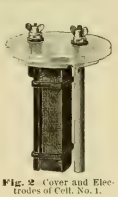


Fig. 2. Cover and Electrodes of Cell. No. 1.

Fig. 3. Cover and Electrodes of Cell No. 2.

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QUALITY UNEQUALED
FACTORY PRODUCTION TRIPLED.
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ELECTRIC HEATERS AVAILABLE TO ALL. MINIMUM EXPENSE.

Portable Heater for residences and offices, size 22 inches long, 11½ inches high, 6 inches wide. Weight 30 pounds.
Highest Efficiency, Simplicity, Durability, Production Guaranteed.
Our Street Car Heaters lead all competitors.
Send for new illustrated circular.
Heating coils renewed like incandescent lamps. Constructed for any voltage. Work on direct or alternating current. Consumes 6. 8 amperes on 110 volt current, 1. 5 on 500 volt current.
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The Zamel Arc Light Meter
AND ELECTRIC CURRENT TIMER
Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights,
It Is Positive in Its Action.
SEND FOR CIRCULAR.

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BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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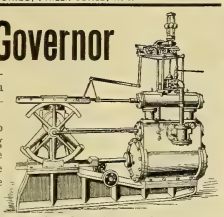
Water-Wheel Governor



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We build governors adapted to all makes of water-wheels, working under all conditions. 70,000 horse power in use. We guarantee the best speed regulation which can be obtained under any conditions.

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Pack of playing cards are sent to everyone sending us two 5-lb. or one 10-lb. labels cut from the front of "**Eureka**" **Packing** boxes. An artist's model posed for the JOKER, the ace and backs are special designs. You know "**Eureka**." It's better than any other. **Try Eureka**

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For Open and Closed Circuit Work.

The Perfect, Modern, Longest Lived and Most Economical Cell Ever Put on the Market.

In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM: Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cheapest; not freezing at 20° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 250 ampere hours; for No. 2 cell, 100 ampere hours; on open circuit, 3 to 4 volt; on closed circuit, .65 to .75 volt. Send for circular and price list.

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BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.

General Agency: Chicago General Fixture Co., 169 Adams Street, Chicago, Ill.

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Apparatus for

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Engineers and Contractors

Desiring a ***thoroughly reliable*** Automatic Starting Apparatus for electric pumps, elevators and other intermittent work, cannot do better than send for our catalogue of Motor-Driven Starters and Specialities. No dash-pots, shunt magnets or other delicate mechanism, yet automatic start and instantaneous release under all conditions.

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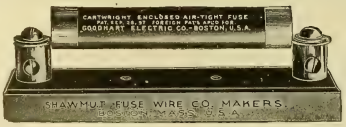

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COMPLETE STOCK CARRIED BY

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

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St. Louis Electrical Supply Co., St. Louis.
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WANTED.

Salesman for Electrical Work.

A permanent position offered by a large manufacturing company for a first class salesman on electrical apparatus. The position offers a large opportunity for an ambitious man of the first class. A technical training and a considerable knowledge of electrical engineering are necessary. Preference will be given to a man who can secure business immediately. In replying give full information covering the following headings: Age, education, business experience in detail, amount of business successfully handled, salary expected, state whether married or single, give five references. Address "**X. Y.**," care WESTERN ELECTRICIAN, 510 Marquette Building, Chicago.

WANTED.

Electrician who is thoroughly competent to design modern multipolar motors and dynamos. Must be good draughtsman. Address "**Motor.**" care WESTERN ELECTRICIAN, 510 Marquette Building, Chicago.

WANTED.

A thoroughly competent man to take charge of the armature and field winding department of one of the leading electrical companies. With application state experience, what wages would be expected and also if now engaged in this work. Address "**Armature.**" care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

$100 MAN WANTED.

We wish to secure the services of a good engineer and electrician for night run. Send 10c. in stamps for application papers, etc. Place must be filled within thirty days. Address **E. H. P. Co.**, 1139 Hamilton Street, Cleveland, Ohio.

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By electrician and engineer of seven years' experience, technical education; capable of taking charge of construction work or operation of a plant; familiar with the management of dynamos, high speed and Corliss engines and the use of the indicator. Good recommendations from prominent parties. Address "**H H.**," care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

POSITION WANTED.

By young man 30 years of age, as superintendent of electric light plant or electric street railway. Has had 10 years experience as superintendent. At present superintendent of electric light plant in the East. Wishes to make a change. Understands all systems. Best of references from present and past employers. Correspondence solicited. Address "K ," care WESTERN ELECTRICIAN, 510 Marquette Bldg , Chicago.

POSITION WANTED.

An electrical engineer of 14 years' experience wants position as superintendent or chief engineer of power station, or as superintendent of construction or erection of plants; long experience in managing large storage battery installations; also as municipal electrical inspector. Am a practical machinist and steam engineer. Best of references. Address "**Megohm.**" care WESTERN ELECTRICIAN, 510 Marquette Bldg , Chicago.

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ARMATURES TO REWIND.

Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.

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Railway Generators.

Two M. P. generators 175 h. p., speed 550 revolutions for 550 volts; also 220 and 110 volt dynamos and motors, switchboards and instruments.

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Best prices paid for scrap copper wire and commutator segments. Red brass wanted.

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Cheap. 125 volt, 30 ampere Siemens-Halske dynamo. Latest model, almost new, with voltmeter and ammeter; must sacrifice. Address "**Sacrifice**" care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago

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All of the street railway property of the

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A splendid opportunity for interurban extension. For particulars address

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FOR SALE.

Two automatic high-speed 9x14 simple Atlas engines, direct connected to 20-foot line shaft between them, fitted with balance wheels, clutches and two pulleys for belting to dynamos or other machinery. May be seen running independently or together any day. Reason for selling—built new plant. Address **A. W. Wright**, Alma, Mich.

For Sale Cheap.

One A-30 T.-H. Alternator 1,000 v. Ironclad Armature with Exciter and Switchboard, with all instruments complete. One 45 k. w. Standard Generator 500 v. Compound Wound. One 15 h.-p. 500 V Detroit motor. One 15 h.-p. 500 V Commercial motor. One 50 light 1,200 c. p. Arc Dynamo Standard. One 30 light 1,200 c. p. Arc Dynamo Sperry. **WILLIAM WRIGHT**, 939 Monadnock-Building, Chicago.

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for sale cheap by **The American Engine Co.**, builders of the American-Ball Engines and Electrical Machinery, Bound Brook, N. J.

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An Opportunity for Bargains in Electrical Apparatus

We offer the following apparatus now in the service of the Home Electric Light & Power Co., Elkhart, Ind., and will be replaced by April 1st with electrical apparatus of larger units:

Two 50-light 2,000 c. p. Standard Arc Dynamos, self-oiling bearings, regulator, sliding base, pulley, etc.

One 60-light 2,000 c. p. No. 8 Wood Arc Dynamo, oil cup bearings, regulator, sliding base, pulley, etc.

Four 45 light 1,200 c. p. No. 7 Brush Arc Dynamos, oil cup bearings, dials, sliding base, pulley, etc.

One 1,000-light National Alternator, 1,000 volts, 16 000 alternations, complete with switchboard instruments and exciter, and an extra armature for Alternator.

One 800-light Westinghouse Compound Wound Alternator, 1,000 volts, 16,000 alternations, self-oiling bearings, complete with switchboard instruments and exciter.

100 Edison Sperry 2,000 c. p. single carbon H. T. Arc Lamps, with 5/8-in. carbon holders

25 Wood 2,000 c. p. single carbon H. T. Arc Lamps, with ½-in. carbon holders.

50 T. & H. 1,200 c. p. single carbon Arc Lamps with ¼-in. carbon holders.

25 Hafermeister 1,200 c. p. single carbon Arc Lamps with ½-in. carbon holders.

5,000 lights capacity Transformers, 1,000 volts to 100-50. We also have a number of Wood Split Pulleys and Clutches of various sizes, Leather Belts, etc., on which very attractive prices will be made. This apparatus will be thoroughly overhauled, repainted and varnished and bright parts all polished. Prices are exceedingly attractive and will interest you. Write us. Address

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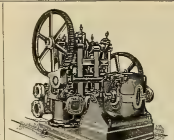

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WATER WORKS PUMPS, ETC.
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Pumping Machinery for Every Possible Duty. New Catalogue Free.

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PROPOSALS

FOR

Arc Lamp Posts on Humboldt Boulevard.

CHICAGO, March 14, 1898.

Sealed proposals will be received by the West Chicago Park Commissioners, at office Union Park, until 4 o'clock p. m. of Tuesday, March 22, 1898, for

Furnishing and Setting 162 Iron Arc Lamp Posts on HUMBOLDT BOULEVARD,

in accordance with plans and specifications on file in the office of the Engineer of said Park Commissioners in Union Park.

Proposals must be made out upon blank forms to be obtained at said office, be addressed to "West Chicago Park Commissioners," indorsed "Arc Lamp Posts," and must be accompanied with currency to the amount of 5 per cent of bid or certified check for the same amount drawn on a responsible bank doing business in the city of Chicago and made payable to the order of the West Chicago Park Commissioners.

The contractor to whom this work may be awarded will be required to furnish a bond in a sum equal to one-half the amount of contract, with sureties acceptable to said Park Commissioners.

No proposal will be considered unless the party submitting it shall furnish evidence satisfactory to the West Chicago Park Commissioners of his or their ability and that he or they have the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract.

The West Chicago Park Commissioners reserve the right to reject any or all bids.

JOSEPH W. SUDDARD, President.
Attest: ERNEST G. SCHUBERT, Secretary.

FOR SALE

A complete street lighting plant to operate 250 24 c. p. series incandescent lamps, consisting of one 12x12 Ideal engine, nearly new; one I. B. Davis pump, No. 2; one Berryman heater, 150 h. p; two Mather series-wound dynamos, capacity 125 24 c. p. lamps each, together with shafting, pulleys, switchboards, etc., will be sold in whole or in part; also two 125 h. p. Westinghouse automatic engines, in use less than a year; one 75 h. p. Westinghouse Junior engine, in use less than a year; one horizontal 14x42 Corliss, 75 h. p., in good order. The above will be sold at a bargain, as the company have no further use for same. Address

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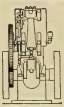

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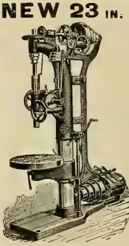

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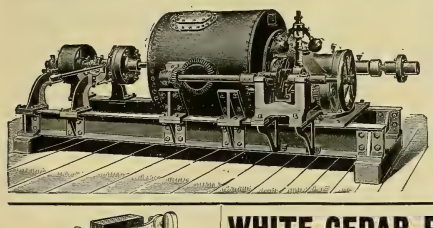

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The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts and where the situation admits of their use we recommend them.

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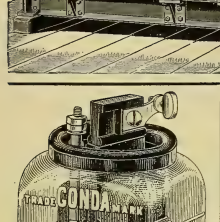

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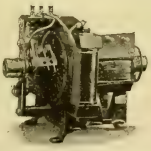

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IT PAYS TO USE THEM.
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FOR UNDERGROUND WIRES.

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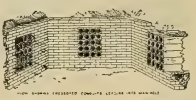

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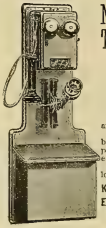

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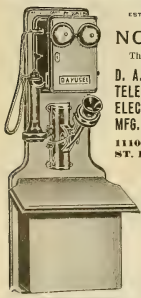

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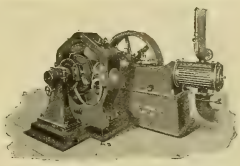

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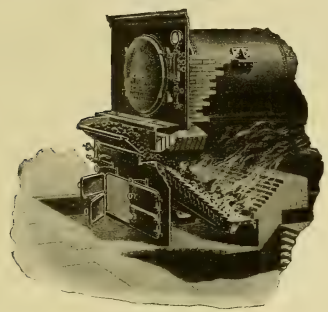

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The Roney Mechanical Stoker obviates all this, enables one to use a cheaper grade of fuel and at the same time to derive the best results from the excellent machinery which receives its power from this service.

If you would know more of this standard piece of apparatus, address:

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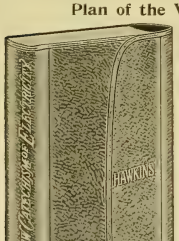
HAWKINS' NEW CATECHISM OF ELECTRICITY.

Plan of the Work, Contents, Etc.



The New Catechism of Electricity will be found to be surprisingly plain, and free from needless and ambiguous terms. The plan upon which it is arranged is unique.

The book is, first of all, intended to be plain and instructive; some 300 illustrations have been introduced, so that the mere pictures will afford almost a knowledge of the subjects.

It is a school book from the manner in which it proceeds from the simple facts to the abstract principles which the facts indicate; it is also a book of reference through the index of seventeen double columns of fine type pages; by means of this index a thousand items of practical importance are at once available.

It is an up-to-date work, which has cost a large outlay of capital and time, and, in short, it is doubtful if any more attractive look has ever been issued—or one more useful.

The subjects treated upon are as follows: Dedication to Thomas A. Edison, with engraving of Mr. Edison; Preface and Introduction; Nature and Source of Electricity and Magnetism.

The Dynamo; Conductors and Non-Conductors; Symbols, abbreviations and definitions relating to electricity; Parts of the Dynamo; The Motor; The Care and Management of the Dynamo and Motor.

Electric Lighting; Wiring; The rules and requirements of the National Board of Underwriters in full; Electrical Measurements.

The Electric Railway; Line Work; Instruction and Cautions for Linemen and the Dynamo Room; Storage Batteries; Care and Management of the Street Car Motor; Electro Plating.

The Telephone and Telegraph; The Electric Elevator; Accidents and Emergencies, etc., etc.

The full one-third part of the whole work has been devoted to the explanation and illustrations of the dynamo, and particular directions relating to its care and management; all the directions are given in the simplest and most kindly way to assist rather than confuse the learner. The names of the various parts of the machine are also given with pictorial illustrations of the same.

In the Catechism no less than 75 full page illustrations have been given of the various dynamo machines made in different parts of the country, and an equal number of part page illustrations.

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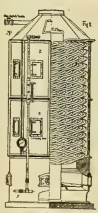

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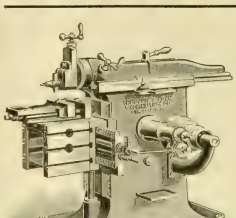

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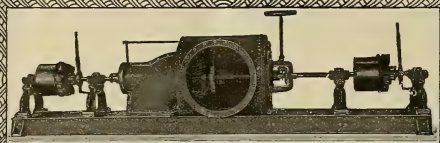

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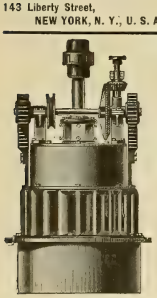

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½	15.11	127.67	133.24	191.06	83.68	½	17.33	178.50	83.95	138.40	83.88
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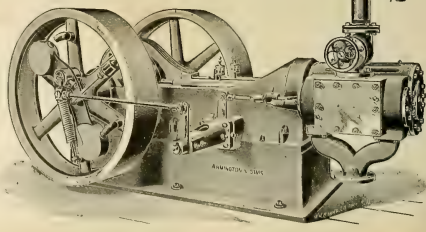

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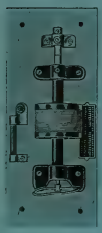

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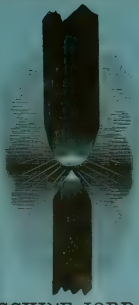

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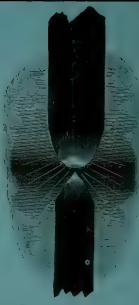

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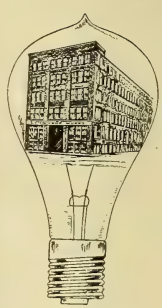

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We having received a very large shipment of

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Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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This meter shows the load passing every instant.
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This meter does not require one-thousandth of a horse power.
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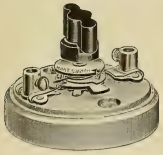
This meter has no springs, jewels or frictional errors.
This meter once right is always right.

Hart 5-Ampere Single Pole Switch.



NO. 20.

Central station managers and others to whom the constant breaking of 5-ampere switches is a source of annoyance and expense, will find that this switch comes up to their most exacting requirements.

Your supply house carries a full stock of Hart Switches and can fill orders without delay.

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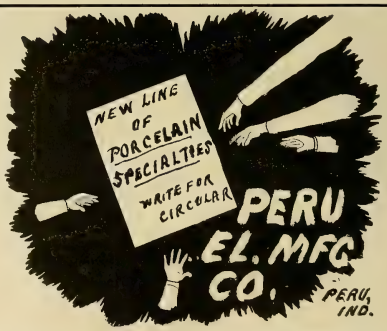

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Note the construction of this Cell.

It is the best Cell for telephone use.

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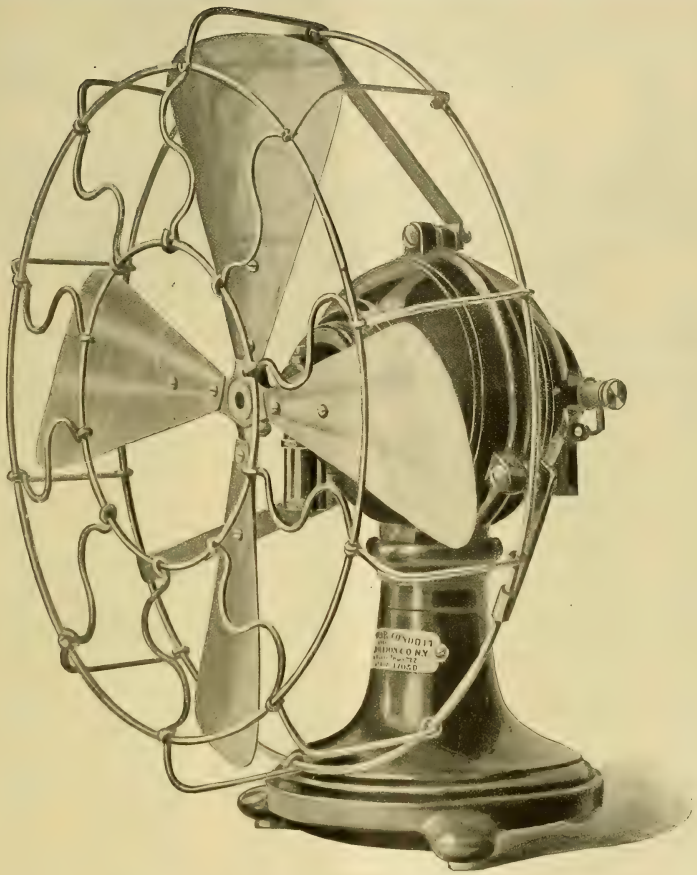

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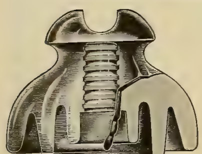

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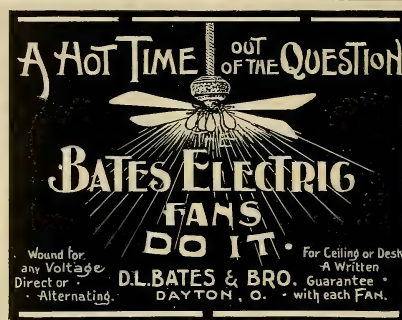

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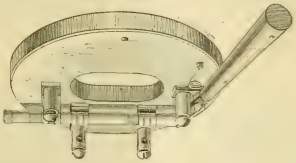

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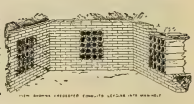

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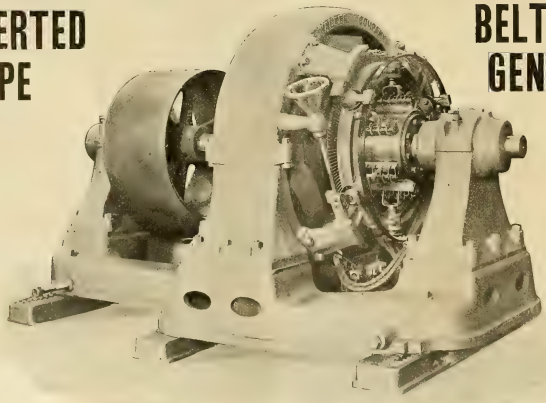

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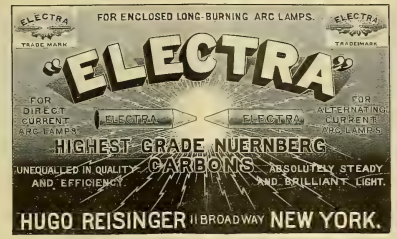

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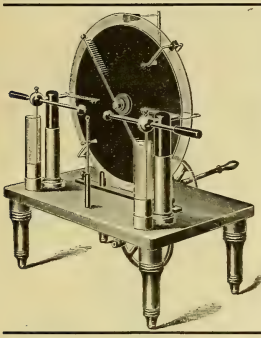

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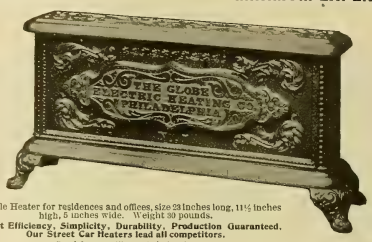

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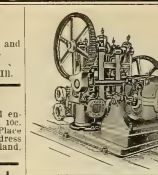

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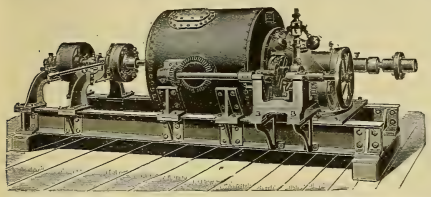

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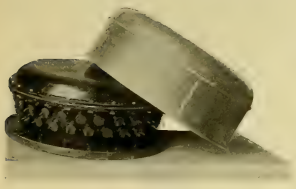

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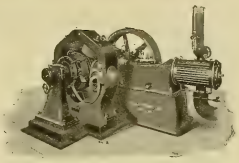

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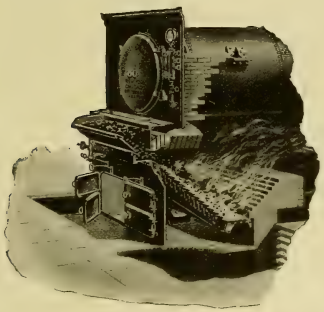

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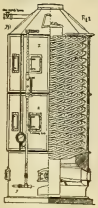

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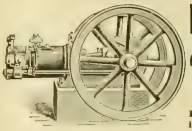

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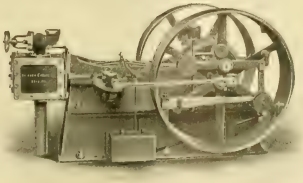

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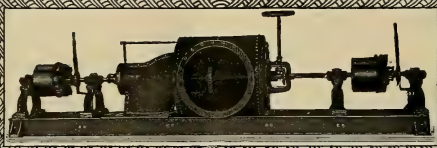

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⅞	15.04	138.12	155.03	223.61	84.55
¾	15.11	127.67	133.24	191.06	83.68
⅝	15.88	131.50	112.65	162.80	80.35
½	16.47	126.87	90.04	127.73	75.93

Test of a 35 inch SAMSON, Feb.1,'97.

Gate Open.	Head.	Rev. Pr. Min.	Cu. Ft. Per Sec.	Horse Power.	Per Cent.
Full	15.29	194.25	202.02	343.44	81.08
⅞	16.56	187.75	192.15	346.73	84.78
¾	17.33	178.50	83.85	338.40	83.88
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½	17.68	168.90	57.69	88.14	76.19

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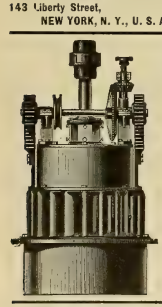

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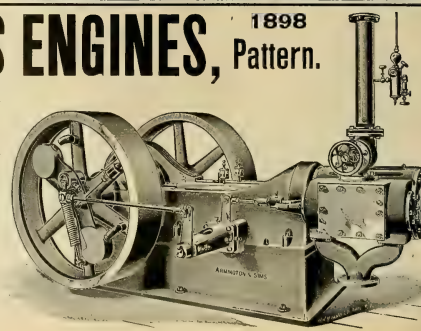

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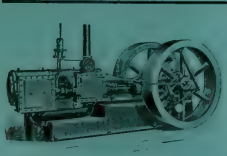

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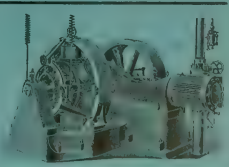

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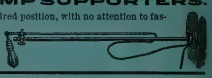

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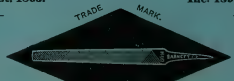

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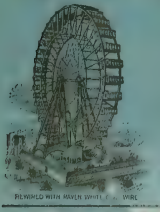

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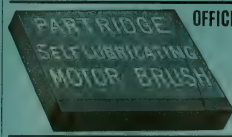

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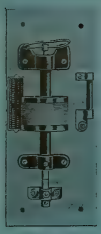

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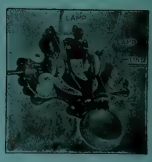

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REGISTERED SEPTEMBER 11, 1894.

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Applied and Sold for Enameling Electric Conduits, Fire-Boxes, Heaters, Lightning Arresters, and all other Appliances.

WRITE FOR ESTIMATES AND QUOTATIONS.

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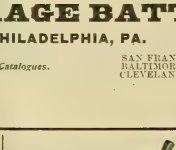
MUNCIE, INDIANA.



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CLEVELAND, OHIO.

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P and B

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PERFECT INSULATION.

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NEW YORK. CHICAGO. HAMBURG. LONDON.

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Manufacturers and Jobbers,

Electrical Supplies at Wholesale Prices.

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We Can Save You Money.

It means more business for us.

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Give us a TRIAL on your NEXT ORDER.

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

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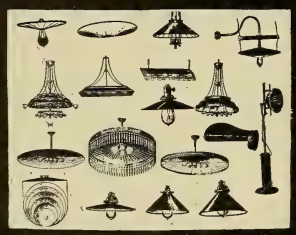

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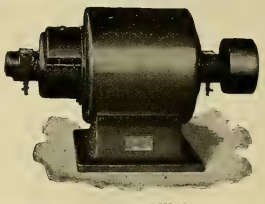
CHICAGO.

THE . . .

Storey Motors.



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Specially Adapted for Direct Connection to Machinery.

Special Direct Current Motors for All Classes of Work.

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BRANCH FACTORY: Hamilton, Canada

Cable address, Storey, Philadelphia. A B C Code used.

ELECTRIC HEATERS AVAILABLE TO ALL. MINIMUM EXPENSE.

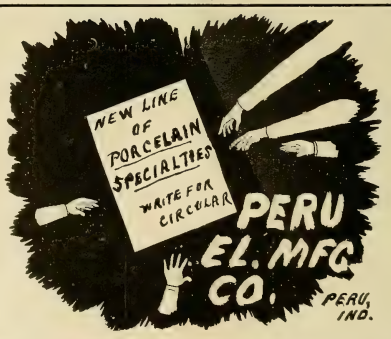
Portable Heater for residences and offices, size 23 inches long, 11½ inches high, 6 inches wide. Weight 30 pounds.

Highest Efficiency, Simplicity, Durability, Production Guaranteed. Our Street Car Heaters lead all competitors.

Send for new illustrated circular.

Heating coils renewed like incandescent lamps. Constructed for any voltage. Work on direct or alternating current. Consumes 6. 8 amperes on 110 volt current, 1. 5 on 500 volt current.

THE GLOBE ELECTRIC HEATING CO., 147 North 12th Street. Philadelphia, Pa.



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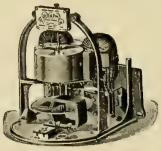
Double Primary Coils,
Double Secondary Coils,
Good Ventilation,
Light Weight,
High Efficiency,
Good Regulation,
Small Iron Loss,
Convenient to Install.

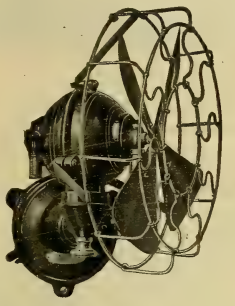
No Brushes,
No Commutator,
No Moving Wire,
Simplicity,
Durability,
Reliability,
Accuracy,
Even to a 6 c. p. Light.



DIAMOND ELECTRIC CO.,

MANUFACTURERS,

Office: 1202 Fisher Building, Chicago, Ill. Factory: Peoria, Ill.



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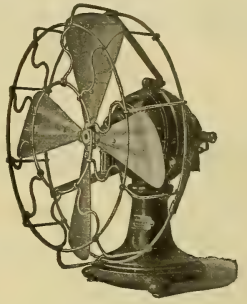

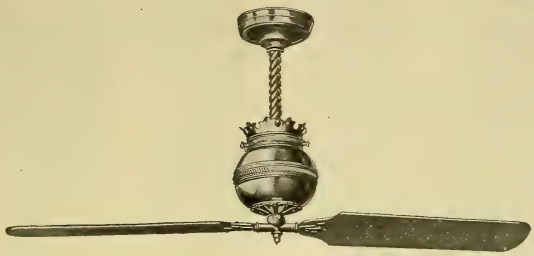

Fan Motors.

Our line of Electric Fan Motors and other ventilating appliances for the coming season will be very complete and include in addition to the Lundell Desk and Ceiling Fans other makes of special apparatus that will enable us to meet all conditions.

We invite correspondence and are prepared to make attractive arrangements for season contracts.

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Geo. A. McKinlock, President.
Charles E. Brown, Secretary.
S. R. Frazier, Treasurer.

OKONITE

Chicago.

Southern Electrical Supply Company, St. Louis.

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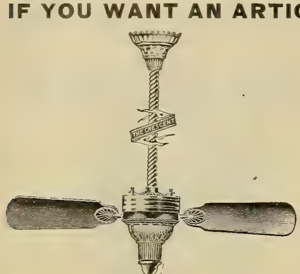

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Wound for Any Voltage.

DIRECT CURRENT.

WRITE FOR PARTICULARS.

Marietta Manufacturing Company,

MARIETTA, PA.

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Electric Storage Battery Co.

Aluminum Castings.
Moser & Wilson.

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Electric Appliance Co.
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Reliable Elec. Supply Co.
Western Electric Co.

Arc Lamps.
Adams-Bagnall Elec. Co.
Central Electric Co.
Commercial El. Supply Co.
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Electric Arc Light Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Gen'l Inc. Arc Light Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Arc Light Cord.
Samson Cordage Wks.

Batteries and Jars.
Ansonia Electrical Co.
Burnley Batt. & Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
Elec. Gas Lighting Co.
Gordon-Burnham Battery Co
Leclanche Battery Co., The
National Carbon Co.
Partrick, Carter & Wilkins.
Peru Elec. Mfg. Co.
Phoenix Carbon Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.

Bells.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Huebel & Manger.
Partrick, Carter & Wilkins.
Proctor-Raymond Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.

Belting.
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L. P. & D. Transmitter Co.
Main Belting Co.
Peerless Rubber Mfg. Co.
Shultz Belting Co.

Boilers.
Ames Iron Works.
Armington & Sims Co.
Clonbrook Steam Boiler Co.
Westinghouse, Church, Kerr & Co.

Books, Electrical.
Electrician Publishing Co.

Brass Founders and Finishers—Metal Patterns
Moser & Wilson.

Bridges, Floors, Cranes.
Berlin Iron Bridge Co.

Brushes.
Central Electric Co.
Commercial El. Supply Co.
Holmes Fibre-Graphite Co.
K. & W. Company.
Ohio Elec. Specialty Mfg. Co.
Partridge Carbon Co.

Buildings and Roofing.
Berlin Iron Bridge Co.

Burglar Alarms.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Huebel & Manger
Partrick, Carter & Wilkins.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires). **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
General Electric Co.
Moore, Alfred F.
New York Ins. Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.

Carbons, Points & Plates.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
Gen'l Inc. Arc Light Co.
National Carbon Co.
Partridge Carbon Co.
Phoenix Carbon Mfg. Co.
Reisinger, Hugo.
Schiff, Jordan & Co.

Compound.
Atlantic Alcatraz Asph. Co.
Boiler Expurgator Co.
Central Electric Co.
Dearborn Drug & Chem. Wks
Electric Appliance Co.
K. & W. Company.
Mass. Chemical Co.
McLennan & Co., K.
Ohio Elec. Specialty Mfg. Co.
Reliable Elec. Supply Co.
Standard Paint Co.
Western Electric Co.

Conduit and Conduits.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Michigan Pipe Co.

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Bullock Elec. Mfg. Co.
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Chicago Edison Co.
Ft. Wayne Elec. Corporation.
Hawkeye Tel Const. Co.
Hodge, Walsh & Loring.
McRae, A. L.
Morrell Electric Works.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Electric Mfg. Co.
Western Electric Co.

Contractors and Electric Light Plants.
Akron Elec. Mfg. Co.
Bain, Foree.
Broughton, H. P.
Brush Electric Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
McRae, A. L.
Northern Electl. Mfg. Co.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec & Mfg Co.

Conveyors.
Link-Belt Machinery Co.

Copper.
Besly & Co., Chas. H.
Mansfield Temp. Copper Co.
Mitchell Temp. Copper Co.

Copper Wires.
American Electrical Works.
Besly & Co., Chas H.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons. Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.

Cordage.
Samson Cordage Wks.

Correspondence Schools.
Int. Correspond. Schools.

Crookes' Tubes.
Central Electric Co.
Commercial El. Supply Co.
Swett & Lewis Co.

Cross-Arms, Pins and Brackets.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial El. Supply Co.
Electric Appliance Co.
Electric Ry. Equipment Co.
Farr Tel. & Cons. Sup. Co.
Locke, Fred. M.
Michigan Pipe Co.

Cut-Outs and Switches.
Automatic Switch Co.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Hill, W. S. Electric Co.
K. & W. Company.
Leonard, H. Ward Elec. Co.
Paiste Co., H. T.
Peoples Electric Co.
Peru Elec. Mfg. Co.
Phila. Elec. & Mfg. Co.
Reliable Elec. Supply Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Dynamos.
Akron Elec. Mfg. Co.
American Engine Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Northern Electl. Mfg. Co.
Nott & Co., A. D.
Sargent & Lundy.
Sprague Electric Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warner, Wm. F.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wright, Wm.

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Broomell, Schmidt & Co.
Fuel Economizer Co.

Elec. Heating Apparatus.
Globe Electric Heating Co.

Electric Meters.
American El. Meter Co.
Zamel Arc Light Meter Co.

Electric Railways.
General Electric Co.
Sprague Electric Co.
Walker Company.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Bain, Foree.
Broughton, H. P.
McRae, A. L.
Sargent & Lundy.
Westinghouse, Church, Kerr & Co.

Electrical Instruments.
Central Electric Co.
Cherry Electric Works.
Commercial El. Supply Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
General Electric Co.
Hill, W. S. Electric Co.
Keystone El. Instrument Co.
Leonard, Ward, Elec. Co.
Paiste Co., H. T.
Queen & Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Weston Electrical Inst. Co.

Electrical Specialties.
Central Electric Co.
Commercial El. Supply Co.
Hill, W. S. Electric Co.
Ohio Elec Specialty Mfg. Co.
Pacific Electric Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Vought, M. I.

Electro-Magnets.
Varley Duplex-Magnet Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.
Hobart Elec. Mfg. Co.
Nott & Co., A. D.

Enamel.
Sanitary Mfg. & Enamel Co.

Engines, Gas.
Foos Gas Engine Co.
Otto Gas Engine Wks.
Wolverine Motor Works.

Engines, Steam.
American Engine Co.
Ames Iron Works.
Armington & Sims Co.
Ball Engine Co.
Skinner Engine Co.
Westinghouse, Church, Kerr & Co.

Fan Outfits.
Bates & Bro., D. L.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Emerson El. Mfg. Co.
Farr Tel. & Cons. Sup. Co.
General Electric Co.
Marietta Mfg. Co.
Schneider Mfg. Co.
Sprague Electric Co.
Wagner Electric Mfg. Co.
Walker Company.
Western Electric Co.
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Fibre.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Fixtures, El. & Comb'n.
Central Electric Co.
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Flexible Shafts.
Stow Mfg. Co.

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Central Electric Co.
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Paiste Co., H. T.
Partrick, Carter & Wilkins.
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Mica Insulator Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
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Standard Paint Co.
Standard Underground C. Co.
Wagner Elec. Mfg. Co.
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Electric Appliance Co.
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Phillips Insulated Wire Co.
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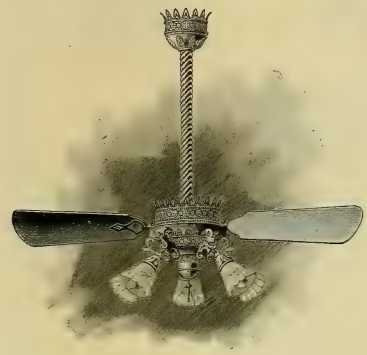

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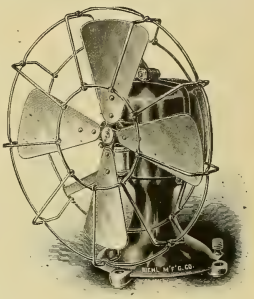

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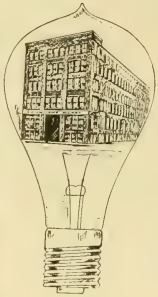

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Alternating Current Fan Motors, Ceiling Fans, Power Motors.

Knife Switches and Switch Boards, Multiple Fuse Boards, Push Buttons.

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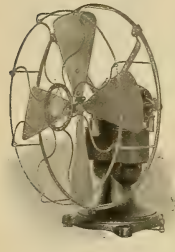
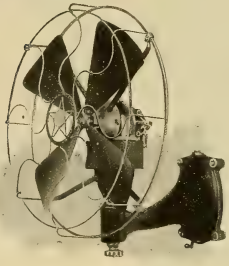


12-Inch Desk Fan.

Voltage—110.
Three speeds—1,875, 1,500, 1,200.



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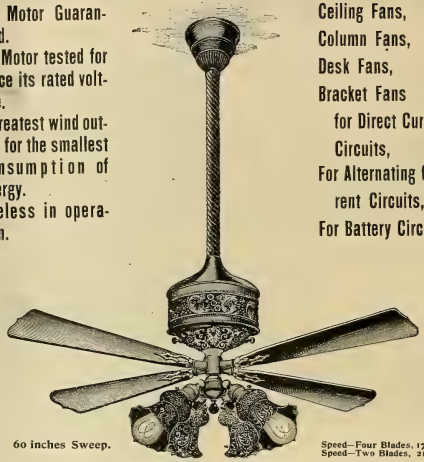
Voltage—110.
Three speeds—1,875, 1,500, 1,200.

Every Motor Guaranteed.
Each Motor tested for twice its rated voltage.
The greatest wind output for the smallest consumption of energy.
Noiseless in operation.



60 inches Sweep.

Four Blades. Three Speeds.

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Every Motor is Wired for Chandelier Attachment.

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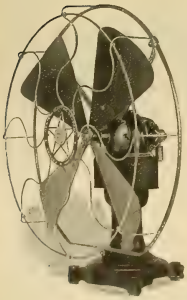

16-Inch Desk Fan.

Voltage—110, 220, 550.
Three speeds—1,375, 1,000, 750.

16-Inch Bracket Fan.

Voltage—110, 220, 550.
Three Speeds—1375, 1,000, 750.

The W. E. 1898 fans are the result of exhaustive experimental tests, the object being to obtain a motor which combines the features of durability and efficiency, as well as all those which appeal to the artistic sense.

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We Handle the Tuerk Alternating Current Ceiling Fan.

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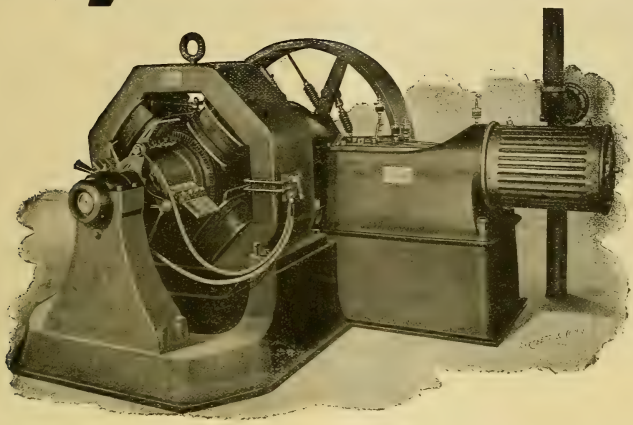

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FOR TELEPHONE, TELEGRAPH AND ELECTRIC LIGHT COMPANIES.

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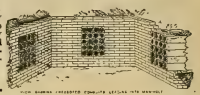

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Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
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Send for descriptive circular and prices.

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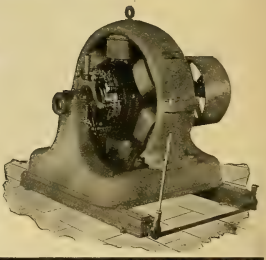

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We make no claim to wonderful inventions revolutionizing the art, or to the employment of all the lamp experts available.

Series Lamps for any service or socket. Responsible representatives wanted in large cities.

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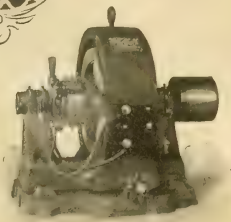

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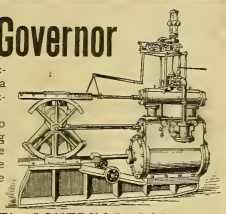

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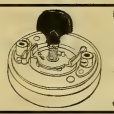

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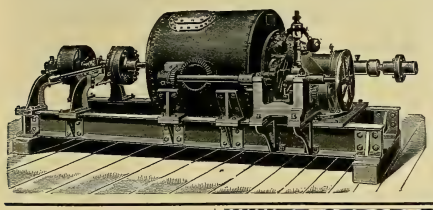

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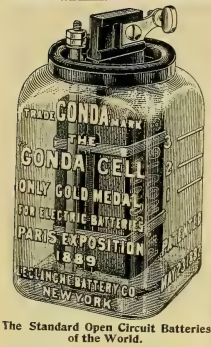

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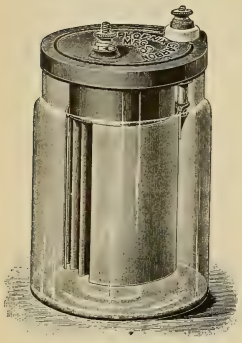

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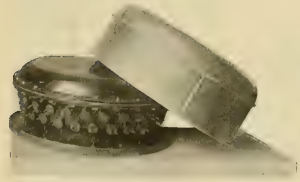

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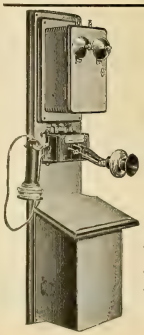

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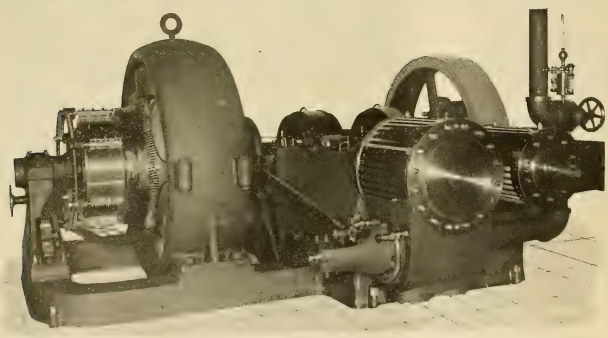

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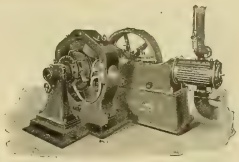

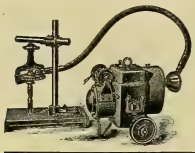

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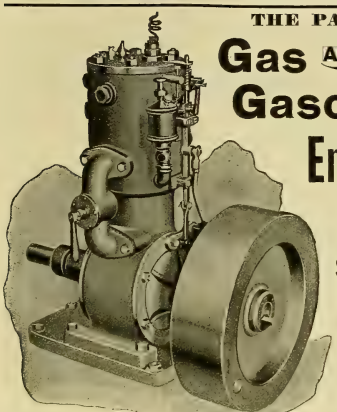

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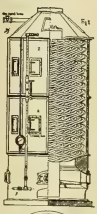

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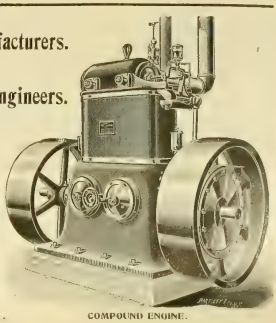

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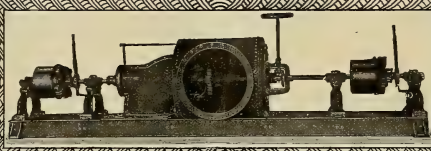

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Full	15.00	144.00	172.69	240.97	83.03	Full	15.30	194.25	102.09	143.44	81.08
⅞	15.04	138.12	155.03	223.61	84.55	⅞	16.56	187.75	92.15	140.73	84.78
¾	15.11	127.67	133.24	191.06	83.68	¾	17.33	178.50	81.95	138.40	83.88
⅝	15.88	131.50	112.65	162.80	80.25	⅝	17.54	170.40	68.89	120.64	80.09
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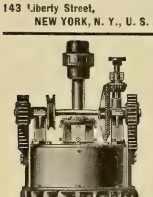

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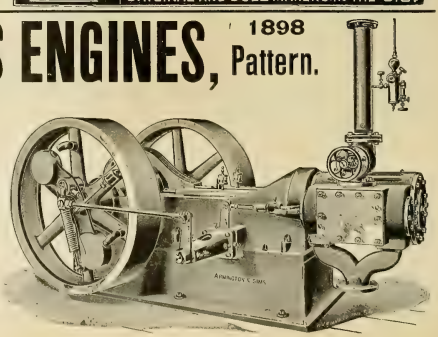

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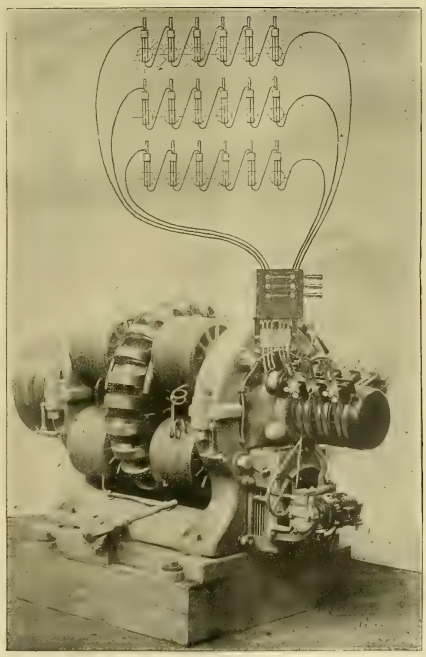

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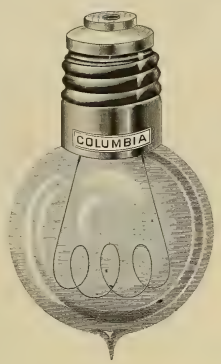

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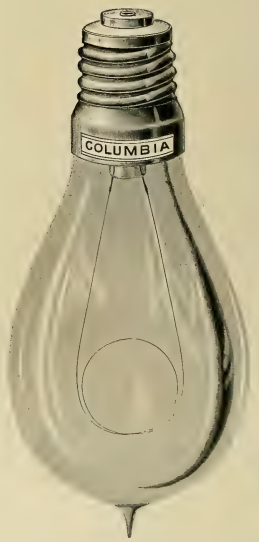

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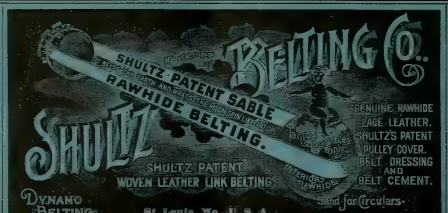

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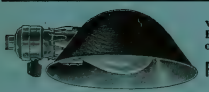

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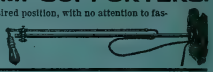

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Vol. XXII. CHICAGO, APRIL 9, 1898. No. 15

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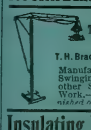

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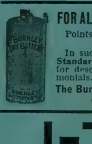

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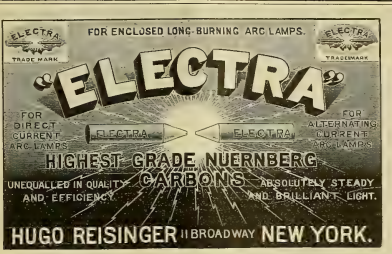

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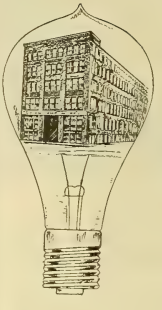

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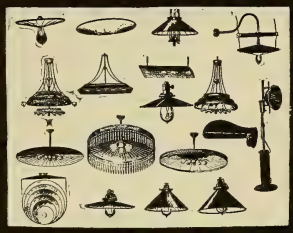

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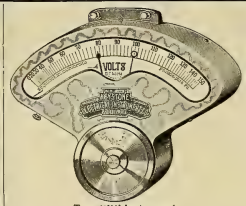

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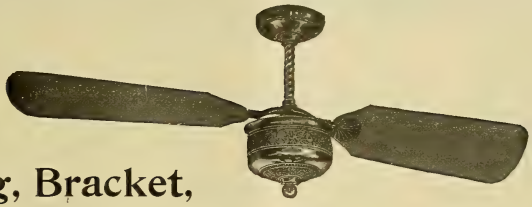

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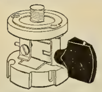
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Berlin Iron Bridge Co.
Brushes.
Central Electric Co.
Commercial El. Supply Co.
Holmes Fibre-Graphite Co.
K. & W. Company.
Ohio Elec. Specialty Mfg. Co.
Partridge Carbon Co.
Buildings and Roofing.
Berlin Iron Bridge Co.
Burglar Alarms.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Huebel & Manger.
Partrick, Carter & Wilkins.
Cables (See Insulated Wires.)
Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
General Electric Co.
Illinois Electric Co.
Moore, Alfred F.
New York Ins. Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Carbons, Points & Plates.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
Gen'l Inc. Arc Light Co.
Illinois Electric Co.
National Carbon Co.
Partridge Carbon Co.
Phoenix Carbon Mfg. Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Compound.
Atlantic Alcatraz Asph. Co.
Boiler Expurgator Co.
Central Electric Co.
Dearborn Drug & Chem. Wks
Electric Appliance Co.
K. & W. Company.
Mass. Chemical Co.
McLennan & Co., K.
Ohio Elec. Specialty Mfg. Co.
Reliable Elec. Supply Co.
Standard Paint Co.
Western Electric Co.
Conduit and Conduits.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Michigan Pipe Co.
Construction & Repairs.
Akron Elec. Mfg. Co.
Bullock Elec. Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Ft. Wayne Elec. Corporation.
Hawkeye Tel. Const. Co.
Hodge, Walsh & Loring.
McRae, A. L.
Morrell Electric Works.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Contractors and Electric Light Plants.
Akron Elec. Mfg. Co.
Bain, Foree.
Broughton, H. P.
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
McRae, A. L.
Northern Electl. Mfg. Co.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse Elec & Mfg Co.
Conveyors.
Link-Belt Machinery Co.
Copper.
Besly & Co., Chas. H.
Mansfield Temp. Copper Co.
Mitchell Temp. Copper Co.
Copper Wires.
American Electrical Works.
Besly & Co., Chas H.
Brixey, W. R.
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Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons. Co., J. A.
Simplex Electrical Co.
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Washburn & Moen Mfg. Co.
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Samson Cordage Wks.
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Int. Correspond. Schools.
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Brady, T. H.
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Central Mfg. Co.
Commercial El. Supply Co.
Electric Appliance Co.
Electric Ry. Equipment Co.
Farr Tel. & Cons. Sup. Co.
Michigan Pipe Co.
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Automatic Switch Co.
Bossert Elec. Const. Co.
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Illinois Electric Co.
K. & W. Company.
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Peoples Electric Co.
Peru Elec. Mfg. Co.
Phila. Elec. & Mfg. Co.
Reliable Elec. Supply Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co.
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Akron Elec. Mfg. Co.
American Engine Co
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
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General Electric Co.
Hobart Elec Mfg. Co
Northern Electl. Mfg. Co.
Nott & Co., A. D.
Sargent & Lundy.
Sprague Electric Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warner, Wm. F.
Western Electric Co.
Westinghouse El. & Mfg. Co.
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Broomell, Schmidt & Co.
Fuel Economizer Co.
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Zamel Arc Light Meter Co.
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Illinois Electric Co.
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Queen & Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Weston Electrical Inst. Co.
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Ohio Elec Specialty Mfg. Co.
Pacific Electric Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
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Sanitary Mfg. & Enamel Co.
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Foos Gas Engine Co.
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Schneider Mfg. Co.
Sprague Electric Co.
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Western Electric Co.
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Delaware Hard Fibre Co.
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Commercial El. Supply Co.
Electric Appliance Co.
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Peerless Rubber Mfg. Co.
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Central Electric Co.
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Western Electric Co.
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Besly & Co., Chas. H.
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Electric Ry. Equipment Co.
General Electric Co.
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Hill, W. S Electric Co.
Illinois Electric Co.
K. & W. Company.
Paiste Co., H. T.
Partrick, Carter & Wilkins.
Peoples Electric Co.
Peru Elec. Mfg. Co.
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Commercial El. Supply Co.
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Lombard Water Wheel Gv. Co.
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Besly & Co., Chas. H.
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Holmes Fibre-Graphite Co.
Hanger Boards.
K. & W. Company.
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Queen & Co.
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Atlantic Alcatraz Asph. Co.
Brixey, W. R.
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Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Diamond State Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Illinois Electric Co.
Kartavert Mfg. Co.
K. & W. Company.
Leonard, H. Ward Elec. Co.
Mass. Chemical Co.
Mica Insulator Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wagner Elec. Mfg Co.
Western Electric Co.
Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
Montauk Multiph Cable Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
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Faries Mfg. Co.
White Co., O. C.
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Westinghouse El. & Mfg. Co.
Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
Garton-Daniels Elec. Co.
General Electric Co.
Westinghouse El. & Mfg. Co.
Magnet Wire.
(See Insulated Wires.)
Mechanical Machinery.
Besly & Co., Chas. H.
Davis & Egan Mach. Tool Co.
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Stilwell-Bierce Smith-Vaile.
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Schoonmaker, A. O.
Mining Apparatus, Elec.
General Electric Co.
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Motors.
Akron Elec. Mfg. Co.
American Engine Co.
Bullock Elec. Mfg. Co.
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Commercial El. Supply Co.
Diehl Mfg. Co.
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Hobart Elec. Mfg. Co.
Northern Electl. Mfg. Co.
Peoples Electric Co.
Sargent & Lundy.
Sprague Electric Co.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co.
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Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.
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Mass. Chemical Co.
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Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd
Platinum.
Baker & Co.
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Berthold & Jennings.
Central Mfg. Co.
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Michigan Pipe Company.
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Valentine-Clark Co.
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Goldsmith Bros.
Swarts Metal Refining Co.
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Amer. Reflector & Ltg. Co.
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Hodge, Walsh & Loring.
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Cornman Co.
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Hodge, Walsh & Loring.
Shades.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
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K. & W. Company.
Speaking Tubes.
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Electric Appliance Co.
Partrick, Carter & Wilkins.
Western Electric Co.
Speed Indicators.
Besly & Co., Chas. H.
Keystone El. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.
Steel Boxes.
Bossert Elec. Const. Co.
Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Street Cars.
Stephenson Co., John.
Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
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Simplex Electrical Co.
Standard Paint Co.
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Commercial El. Supply Co.
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Keystone Tel. Co.
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Kusel, D. A., Tel. & El. Mfg. Co.
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Sterling Electric Co
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Viaduct Mfg. Co.
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Western Tel. Cons. Co.
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Commercial El. Supply Co.
Diamond Elec. Co.
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Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co
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Samson Cordage Wks.
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General Electric Co.
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Stilwell-Bierce Smith-Vaile.
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Vulcanized Fibre Co.
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Brixey, W. R.
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Commercial El. Supply Co.
Electric Appliance Co.
Okonite Co., The.
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Cabinet Mfg. Co.
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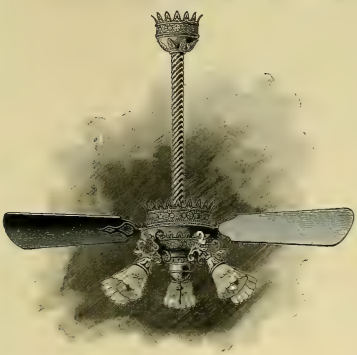
For Alphabetical Index of Advertisements See Page III.

DIEHL FANS

FOR ALL CIRCUITS, EXCEPT ALTERNATING.



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Our Desk and Bracket Fans are Built of the Finest Material and are the

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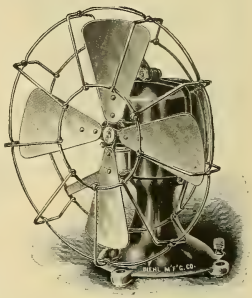

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Every motor guaranteed.
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Gives more breeze,
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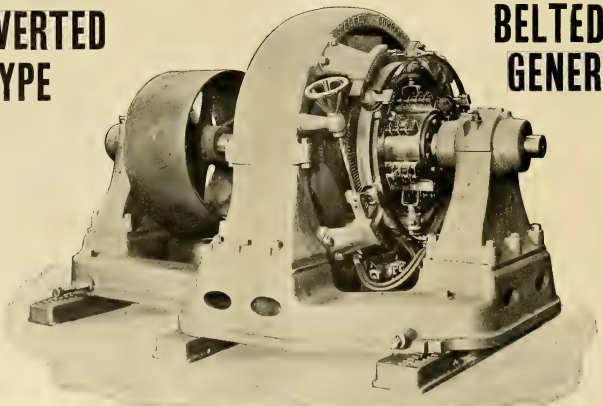

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This question has been put repeatedly by thoughtful and ambitious thousands.
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These accumulating requests demanded recognition—they rose to the nature of a command. We now respond to them publicly after having—during the past two years—been engaged in elaborate preparations to fully meet this need of the times. The work is now consummated, and we take pleasure in announcing herewith

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5. ALTERNATING CURRENT GENERATORS.
6. TRANSFORMERS AND POLYPHASE MOTORS.
7. TRANSMISSION OF ELECTRICITY.
8. ELECTRIC BELL WORK.
9. ELECTRIC LIGHTING.
10. ELECTRIC RAILWAYS.
11. ELECTRIC MINING.
12. ELECTRIC HEATING.
13. ELECTRIC WELDING.
14. TECHNICAL INSTRUMENTS AND MEASUREMENTS.
15. ELECTRO-CHEMISTRY.
16. ELECTRO-PHYSICS (including X-ray work.)
17. PRIMARY AND SECONDARY BATTERIES.
18. ELECTRO-METALLURGY.
19. TELEGRAPHY.
20. TELEPHONY.
21. ELECTRIC SIGNALING (RAILROAD, MARINE, ETC.)
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23. ISOLATED PLANTS AND CENTRAL STATIONS (including their working.)
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26. DESIGN OF TRANSFORMERS AND POLYPHASE MOTORS.
27. ALTERNATE CURRENT WORKING IN GENERAL (including Polyphase Work.)
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We have in preparation **complete courses in all the other engineering and industrial sciences.** A later announcement will state the opening of these courses. We shall be pleased to receive communications from interested parties.

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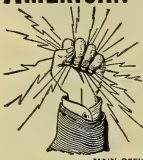

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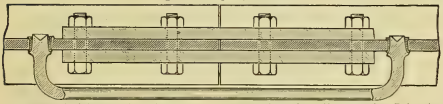

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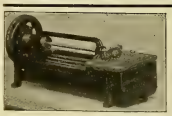

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Salesman for Electrical Work.

A permanent position offered by a large manufacturing company for a first-class salesman on electrical apparatus. The position offers a large opportunity for an ambitious man of the first class. A technical training and a considerable knowledge of electrical engineering are necessary. Preference will be given to a man who can secure business immediately. In replying give full information covering the following headings: Age, education, business experience in detail, amount of business successfully handled, salary expected, state whether married or single, give five references. Address "X. Y.," care WESTERN ELECTRICIAN, 510 Marquette Building, Chicago.

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A position in an electric light plant or station at general wiring, with an opportunity to work myself up; have had four years of practice; good reason for wanting to change place; first-class references furnished if desired. Address S. S., care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

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Two automatic high-speed 9x14 simple Atlas engines, direct connected to 30-foot line shaft between them, fitted with balance wheels, clutches and two pulleys for belting to dynamos or other machinery. May be seen running independently or together any day. Reason for selling—built new plant. Address A. W. Wright, Alma, Mich.

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This advertisement is inserted through our inability to obtain any information regarding who the other creditors are from the receiver of this company.

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2 65-light 3000 c. p. Brush machines, self-oiling.
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111 K-2 single T.-H. arc lamps, 2000 c. p.
2 Adams-Bagnall long-burning enclosed 110 volt arc lamps, new.
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Every machine and lamp guaranteed to be in perfect operating condition; all repaired like new.

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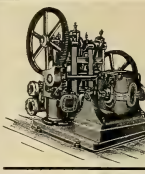

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If you have any Old Copper Wire of any description to dispose of, it will pay you to communicate with us, as we are at all times in the market for any quantity of Scrap Copper Wire, at the highest market values. We pay cash and send prompt returns. We are also supplying the electrical trade with our high grade Babbitt, Cotton Waste, Solder, Etc. Please communicate with us.

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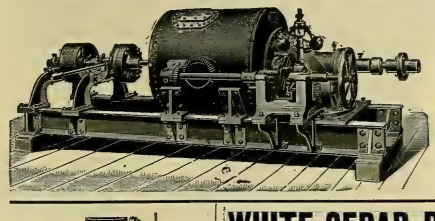

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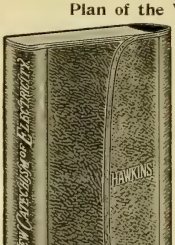
Plan of the Work, Contents, Etc.



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Electric Lighting; Wiring; The rules and requirements of the National Board of Underwriters in full; Electrical Measurements.

The Electric Railway; Line Work; Instruction and Cautions for Linemen and the Dynamo Room, Storage Batteries; Care and Management of the Street Car Motor; Electro Plating.

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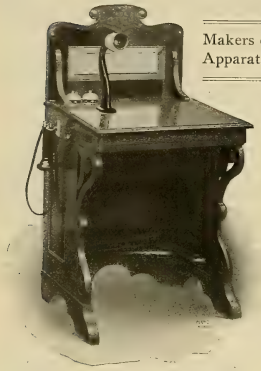

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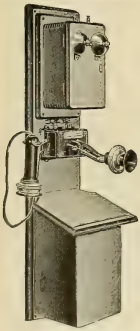

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Receivers Unequaled in Power—Indestructible.

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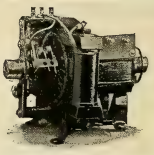

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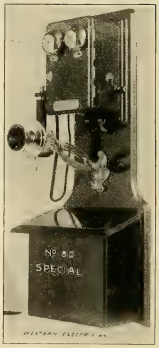

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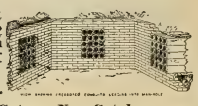

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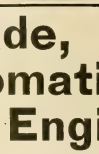

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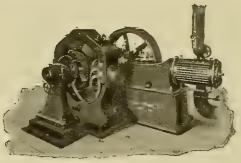

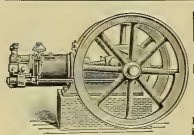

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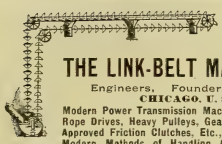

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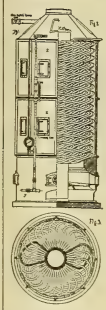

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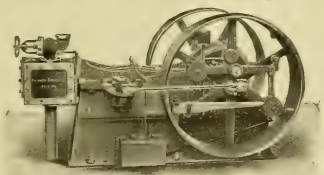

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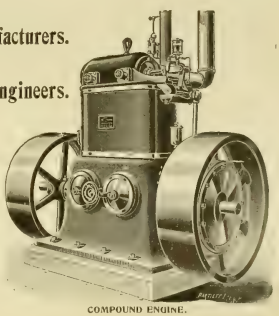

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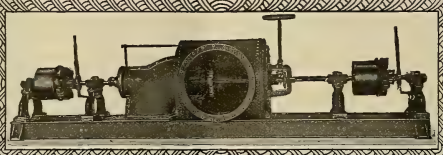

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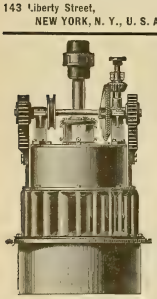

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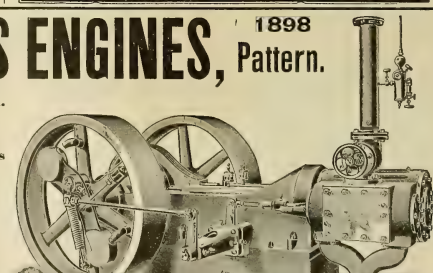

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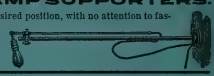

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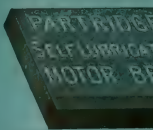

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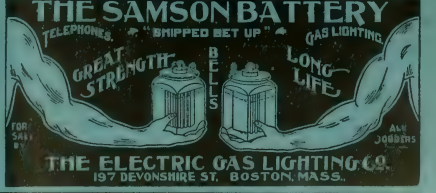

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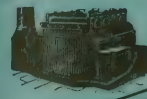

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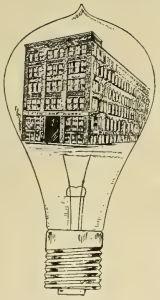

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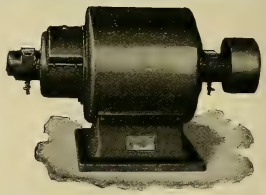

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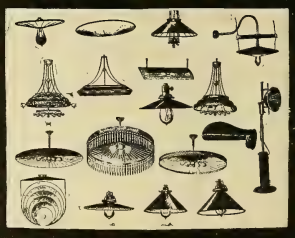

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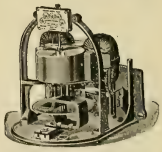

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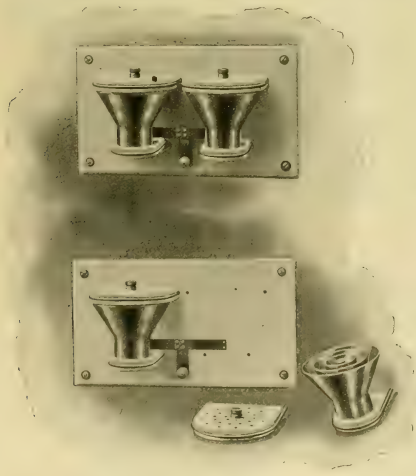

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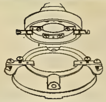
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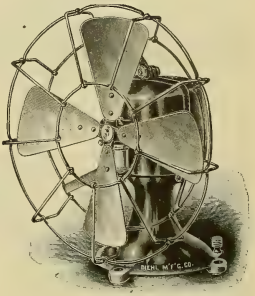

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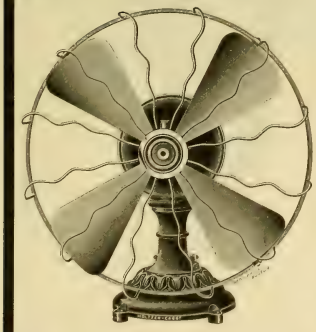

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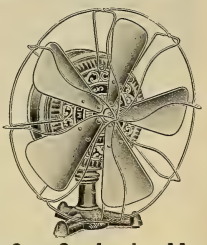

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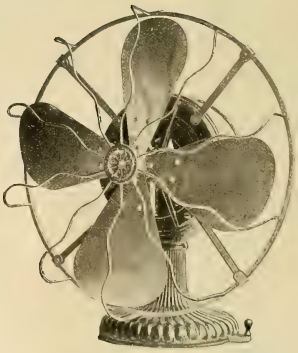

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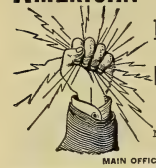

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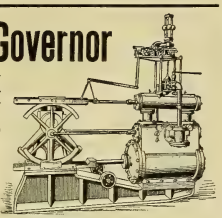

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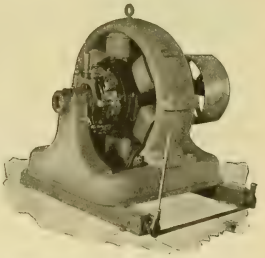

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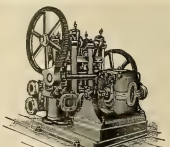

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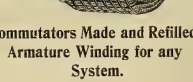

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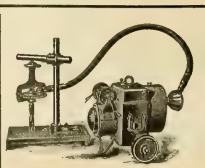

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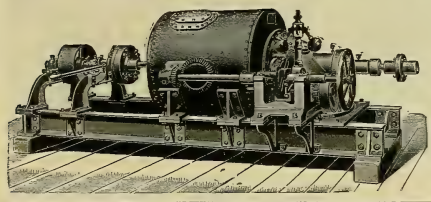

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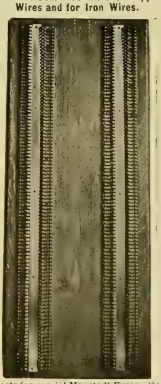

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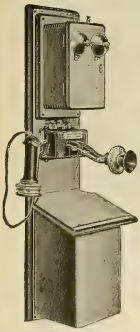

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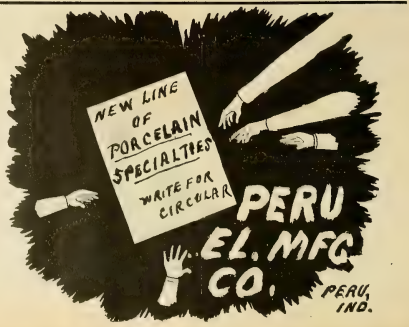

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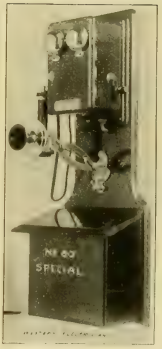

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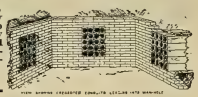

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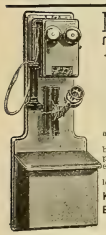

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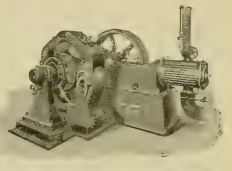

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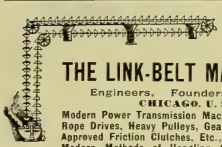

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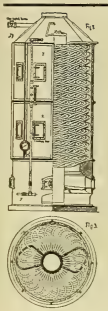

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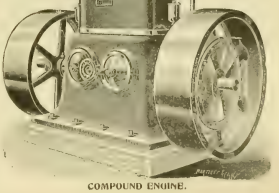

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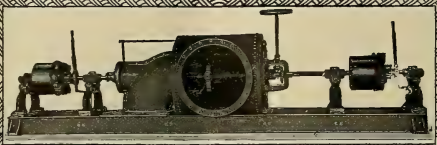

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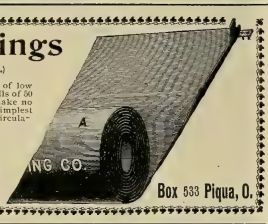

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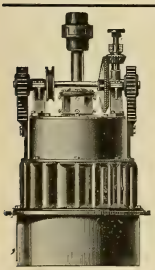

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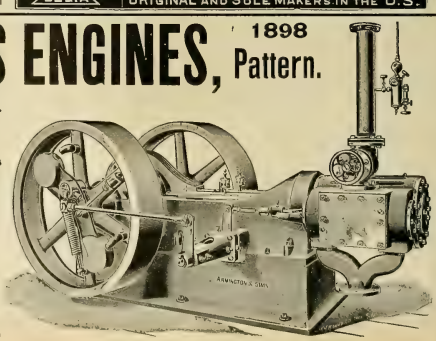

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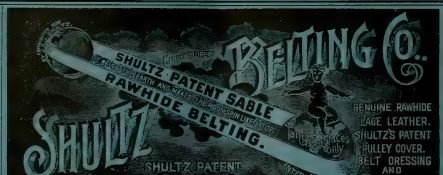

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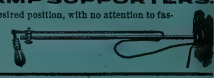
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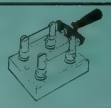

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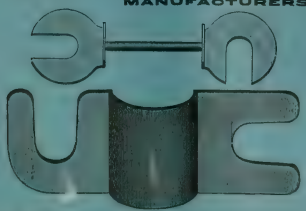

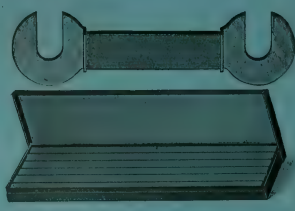

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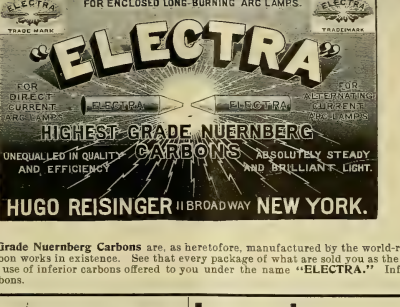

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F. HARDTMUTH & CO., VIENNA, AUSTRIA.

We having received a very large shipment of

CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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Switchboard Voltmeters, Ammeters, Ground Detectors and Differential Voltmeters.

We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

Our instruments are constant and durable, sensitive and accurate, pleasing in appearance and always correct.

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Ninth Street and Montgomery Avenue, Philadelphia.
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Is now prepared to take orders for early delivery of all sizes of 3-Wire Constant Potential Registering Meters.

This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
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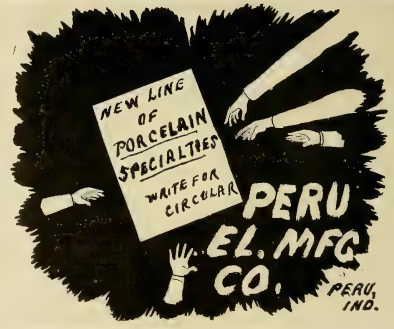

For long distance and hard worked phones, use the National No. 3 Carbon Porous Cup Cell; the largest open circuit cell in the field. Elements adapted to a standard 6 in. x 8 in. jar.

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1898

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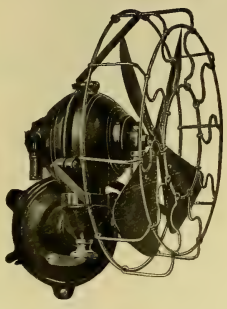
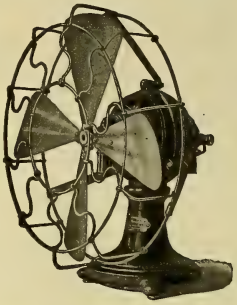
562 S. " " - - 13.50

560 B. Bracket Fan, - - 10.50
564 B. " " - 13.50



560 B. 12 Inch Fan.
564 B. 16 " "



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562 S. 16 " "

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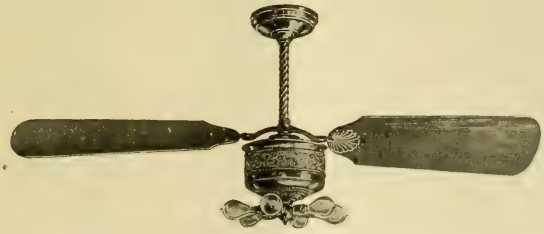

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Without Electrolier Attachment for 110 Volts, $22.00.

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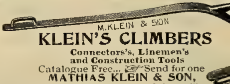

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Berthold & Jennings.
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Lindsley Bros.
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Pittsb. & L. Sup. Iron Co.
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Faries Mfg. Co.
Spark Arresters.
K. & W. Company.
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Central Electric Co.
Electric Appliance Co.
Partrick, Carter & Wilkins.
Western Electric Co.
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Keystone El. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.
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Bossert Elec. Const. Co.
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American Battery Co.
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Stephenson Co., John.
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American Electrical Works
Brixey, W. R.
Central Electric Co.
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Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Paint Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
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FOR ALL CIRCUITS, EXCEPT ALTERNATING.

OUR CEILING FANS AND ELECTROLIERS
ARE THE

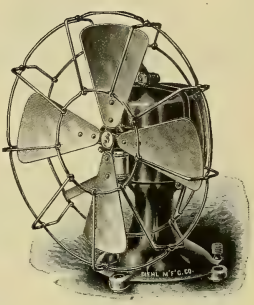
Recognized Standard

OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency

Of Any on the Market.



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ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway.
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ELIZABETHPORT, N. J.

BUYERS will find no better or more honestly made goods than those of the K. & W. Company of Pittsfield, Mass. Their Hardy Incandescent Lamp is justly celebrated for its sustained candle power. Their Arc Hanger Board—an absolute cut out—is a model of workmanship and design. Their Dynamo Brush is a cool and quiet runner, and their Commutator Compound does prevent sparking. They have a New York Office at 120 Liberty Street, and their Western representatives are Meysenburg & Badt, 1504 Monadnock Block, Chicago. Their prices are moderate and parties wishing agencies will do well to communicate with them.

JUST AN OUTLINE.

THE STORY
IS TOLD.

Remember last year the days that were warm,
And the flies how they came swarm upon swarm,
And how the hot air sizzled and baked,
And how oft'en and oft'en our thirst we slaked.
Remember how wilted the collars became,
And our shirts and our cuffs and ourselves the same.
Then remember, just remember, to buy in time,
The original, a fan, like this outline.

FOR FURTHER DETAILS SEND
FOR THE FAN CATALOG.

Western Electric Company,

CHICAGO. NEW YORK.

EFFICIENT,
NOISELESS,
DURABLE,
HANDSOME.

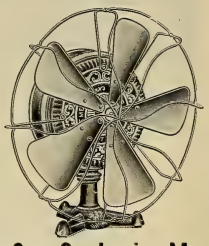
NEW DESIGNS
NEW FINISHES

Alternating Ceiling Fans and Desk Fans.

ALL VOLTAGES—FOR ANY FREQUENCY.

We Sell to the Trade Direct.
No Exclusive Agents.

Advise us the quantity of Motors you can handle and get our prices.



Send
For Catalogue.

LOOK!

The Emerson Electric Mfg. Co., St. Louis, Mo.

A HOT TIME OUT OF THE QUESTION

BATES ELECTRIC FANS DO IT

Wound for any Voltage, Direct or Alternating.

D.L. BATES & BRO. DAYTON, O.

For Ceiling or Desk. A Written Guarantee with each FAN.

SUPPLIES!

Lowest Quotations on
Electrical Supplies.

PROMPTEST SHIPMENTS.

Reliable Electrical Supply Co.,

236½ EAST MADISON ST., CHICAGO.

WAR!

AND

Summer's Heat Are Upon Us.

KEEP COOL.

Our Fan Motor

THREE SPEEDS, BEAUTY and DURABILITY.

AGENTS

RUBBER COVERED WIRES AND CABLES.

12-Inch Desk Fan Motor.

MADE FOR
110, 220, 500 VOLTS.

EVERY MOTOR GUARANTEED.

Desk Fans, 12 and 16 Inch.
Ceiling Fans, 2 and 4 Blade.

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Edison Jr. Improved Incandescent Lamps.

For Electrical Supplies, write us for our monthly circular.

Illinois Electric Co., 239 Madison St., Chicago.

President, Frank E. Healy. Secretary, Lemuel K. Cushing. Treasurer, Carl Keith.

"A Work of Art"

IS THE JUDGMENT OF EVERYONE
WHO HAS SEEN OUR 1898

Lundell Fan Motor Catalogue.

Its cover is in vermilion and gold, of special design, and its text pages fulfill the promise of the cover, beautifully illustrated as they are with half-tone vignettes, and superlatively printed upon heavy plate paper. It is the FINEST CATALOGUE OF THE SEASON, and it shows the best line of Fan Motors in the world. Everybody directly interested, should possess a copy, and may, by addressing....

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SPRAGUE ELECTRIC CO.,

Twenty Broad Street,

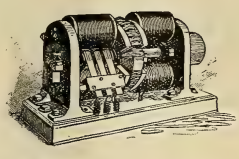
NEW YORK CITY.

THE BRUSH ELECTRIC COMPANY

BRUSH

THE BRUSH ELECTRIC COMPANY

Brush apparatus has been on the market for twenty years. A majority of customers order supply parts direct from us. Many do not. We want this trade and have reduced our prices. Ask for quotations and send orders to the nearest Sales Office.



FIRST BRUSH ARC DYNAMO—1877.

SALES OFFICES:

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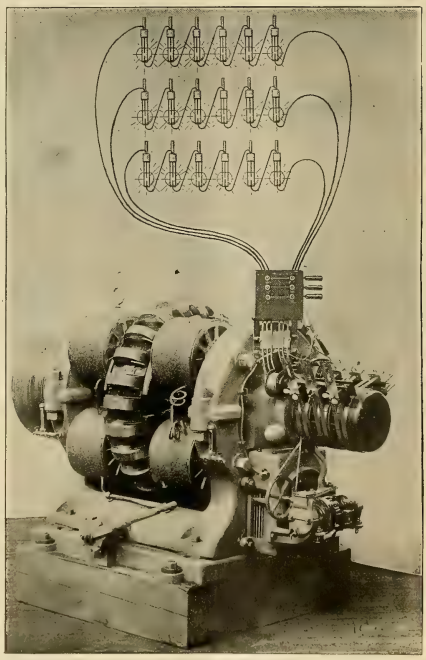
Philadelphia, Pa., 509 Arch Street.
Cincinnati, Ohio, 429 West Fourth Street.
Chicago, Ill., Monadnock Building.
St. Louis, Mo., Wainwright Building.
Atlanta, Ga., Equitable Building.
Denver, Colo., Kittredge Building
San Francisco, Cal., 15 First Street.
Toronto, Ont., Canadian Gen. Elec. Co., Ltd.
Pittsburg, Pa., 502 Tradesman's Bank Building.

Many stations have exchanged all their small units for large Brush arc dynamos. Among them in lights' capacity are:

Buffalo	4,250
Brooklyn-Citizens	3,360
Newark, N. J.	3,000
New Orleans	2,250
Cleveland	1,800
Philadelphia Brush	1,500
Philadelphia-Northern	1,300
Brooklyn-Municipal	1,200
Worcester	1,000
Washington, D. C.	1,000
Toronto	900
Harrisburg	750
Erie	750
Malden, Mass.	720
Cambridge, Mass.	720
Norfolk, Va	720
City of Chicago	700
Boston, Mass.	660
Quebec	625
Paterson	625
John Wanamaker	625
Brooklyn, Kings Co.	625
Rockford, Ill.	625
Albany	500
Troy	500
Carnegie Steel Co.	500
Manchester, N. H.	500
Reading, Pa.	500



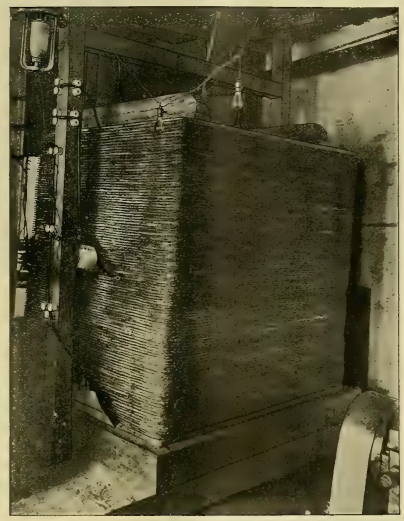
BRUSH MULTI-CIRCUIT 125-LIGHT ARC DYNAMO—1898.

Over 60,000 lights' capacity in large Brush arc dynamos sold. A large proportion of them using Multi-Circuit Dynamos.

The newly designed Brush dynamos have the following capacities: 55, 80, 100, 125, 240, 300, 2,000 candle power lights; 45, 85, 120, 160, 1,200 candle power lights.

Brush arc lamps were first used in 1877. More of them being sold to-day than ever before.

Two or more separate circuits run direct from one dynamo with any distribution of load on the different circuits. The advantages are absolute flexibility in handling of circuits; reduction of high voltages on circuits run from large dynamos; use of large units with corresponding increase of efficiency; saving in floor space, oil, belts, shafting, pulleys, attendance.



What would you say to a Storage Battery giving any Voltage and Capacity in a Single Cell? . . . . .

The High Tension Storage Battery

Is such a battery. Furnished in all sizes from portables to station batteries of 5,000 ampere-hour capacity and over. Two volts per plate. Odorless. No slopping of acid. Self contained. No falling out of plugs. No short circuiting. View of 220 volts High Tension Storage Battery of 3,000 ampere-hours capacity at Souderton, Pa., furnishing current for street and private lighting.

Correspondence solicited with reliable parties desiring to act as agents. For full particulars and catalogue address

THE HIGH TENSION ELECTRIC STORAGE CO.

FACTORY, SOUDERTON, PA.

Heed Building, 1215 Filbert St., Philadelphia.

WE OFFER

MANHATTAN

JUNIOR

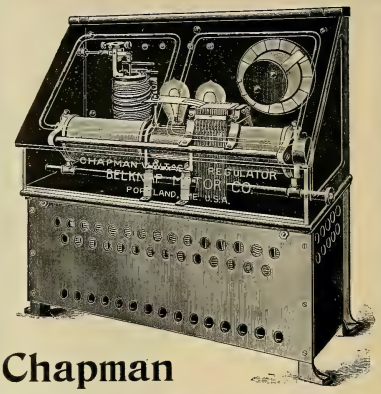
Enclosed Arc Lamps,

NOW SOLD AS "JANDUS."

24 inches, 3 amperes, inside or outside service, oxidized brass shells,

FOR $15.00 EACH.

Manhattan General Construction Co.,
11 BROADWAY, NEW YORK.



Chapman Voltage Regulators

insure **Steady Light** from unsteady power.
For use with Steam or Water Plants.
—No Attendance Required.—
Regulator sent on 30 days' trial.
Let us show what it can do for you.

Belknap Motor Company,
474-478 Fore Street, PORTLAND, MAINE, U. S. A.
New York Office, 27 Thames Street. Boston Office, 620 Atlantic Ave.

BERGMANN

New Alternating Enclosed Arc Lamp

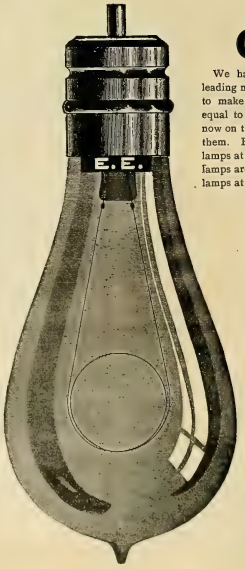
ANY FREQUENCY.

Same Method of Trim as the Standard D. C. Lamps.

ARC LAMP SALES DEPARTMENT

General Incandescent Arc Light Co.,
11 BROADWAY, NEW YORK.

A Strictly High-Grade Lamp



15 CENTS.

We have just arranged with one of the leading manufacturers of incandescent lamps to make for us a strictly high-grade lamp, equal to any of the so-called "Trust" lamps now on the market, and superior to many of them. For the next 60 days we offer these lamps at 15 cents each, in barrel lots. These lamps are fully guaranteed. We sell refilled lamps at 13 cents each. Give us a trial order.

New Midget Upton 150-Hour Arc Lamp for 110-Volt Circuit, $15.00
For Alternating Circuit, 20.00
A full line of Electrical Supplies carried in stock. Lowest possible prices.
2½-Inch Shade Holders, per doz., 25c.
Edison Wiring Receptacles, each, 4c.
Climbers, per pair, - - - 75c.
2-Inch Iron Box Bells, each, - 20c.
Send for copy of the "*Electrical Bulletin.*"

Electrical Machinery.

Over 1,000 machines for sale, of standard make: Incandescent Dynamos, Arc Dynamos, 110-220 and 500-Volt Motors, Motors for Alternating and Arc Circuits. Send for complete list. Arc Lamps, Transformers, Alternating and Direct-Current Meters. All standard makes in stock. Send for list giving net prices.

The Electrical Exchange,
Dealers in Everything Electrical,
166-174 S. Clinton St., CHICAGO.

No charge for boxing and carriage if "Western Electrician" is mentioned.

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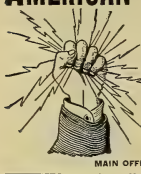
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

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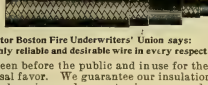
THE "CLARK" WIRE.

FOR SWITCHBOARD. RAILWAY and MOTOR USE.



All sizes of Stranded and Flexible Wire and Cables with Clark's Insulation

Inspector Boston Fire Underwriters' Union says:
"A thoroughly reliable and desirable wire in every respect."

The Clark wire has been before the public and in use for the past ten years, and has met with universal favor. We guarantee our insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class insulated wire. We shall be pleased to mail Catalogues, with terms and discounts for quantities.

EASTERN ELECTRIC CABLE COMPANY,

HENRY A. CLARK, Treas. and Gen'l Manager.
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Write for circular, stating subject in which you are interested.

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Desiring a *thoroughly reliable* Automatic Starting Apparatus for electric pumps, elevators and other intermittent work, cannot do better than send for our catalogue of Motor-Driven Starters and Specialties. No dash-pots, shunt magnets or other delicate mechanism, yet automatic start and instantaneous release under all conditions.

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For our free book entitled **"Can I Become an Electrical Engineer?"** address

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(Conducted under the auspices of *The Electrical Engineer.*)

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120 Liberty Street, NEW YORK, U. S. A.

STRENGTH is that quality which line wire must possess in order that reliable and uninterrupted service is assured. A line wire without strength yet possessing high conductivity is just as deficient from the point of view of good workings as a strong wire which is not a good conductor. A happy medium between the two is found in

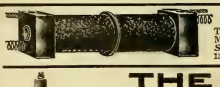
BI-METALLIC WIRE,

Composed of copper and steel; a wire which partakes of the good electrical and mechanical qualities of the metals of which it is formed. The question of cost is worthy of consideration because Bi-Metallic Wire is

CHEAPER THAN COPPER.

John A. Roebling's Sons Co., Trenton, N. J.

117-119 Liberty St., New York. 171-173 Lake St., Chicago.
32 South Water St., Cleveland. 27 Fremont St., San Francisco.



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Telephone Induction Coils, Ringer and Bridge Bell Magnets, Drop Magnets, etc. Also *Gas Lighting Spark Coils.* THE VARLEY DUPLEX MAGNET CO., 188 Seventh St., Jersey City, N. J.

Frederick Sargent. A. D. Lundy. Martin J. Insull.

SARGENT & LUNDY,

ENGINEERS,

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GORDON PRIMARY CELL.

For Open and Closed Circuit Work.

The Perfect, Modern, Longest Lived and Most Economical Cell Ever Put on the Market.

In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM:—Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cleanest; not freezing at 28° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 250 ampere hours; for No. 2 cell, 100 ampere hours; on open circuit, 2 to 1 volt; on closed circuit, .55 to .75 volt. Send for circular and price list.

THE GORDON-BURNHAM BATTERY CO.,

82 to 86 West Broadway, New York City.
GEO. W. PATTERSON, 1114 Marquette Bldg., Chicago, Ill.

THE S-W Arc Light Radiators

BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.
General Agency: Chicago General Fixture Co., 169 Adams Street, Chicago, Ill.

Shadowless Radiator Mfg. Co.,

FARIBAULT, MINN.

EVERYTHING IN WIRE.

BARE AND INSULATED.

ALSO MANUFACTURERS OF THE "CHICAGO" RAIL BOND.

WASHBURN & MOEN MFG. CO.,

WORCESTER, MASS.

BRANCH OFFICES AND WAREHOUSES: New York, Chicago, San Francisco, Houston, Philadelphia, Pittsburg, Boston

WEATHERPROOF WIRE.

COMPLETE STOCK CARRIED BY

Western Electric Co., New York.
Electric Appliance Co., Chicago.
Pettingell Andrews Co., Boston.
Electrical Engineering Co., Minneapolis.
St. Louis Electrical Supply Co., St. Louis.
The Bradford Belting Co., Cincinnati.

WEATHER-PROOF TRADE-MARK "O.K." LINE AND HOUSE WIRES

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

WANTED.

An experienced traveling salesman for electric supply house; wages moderate at start. Address "M. E." care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

WANTED.

Three Edison No. 20 (60 K. W.), or three No. 24 (100 K. W.) machine frames and armature cores only. AKRON STREET RY. & ILL. CO., Akron, Ohio.

WANTED.

A competent superintendent for incandescent lamp works. Address "Incandescent," care this paper, stating experience, salary and references.

WANTED

Position as electrician or engineer in an electric light plant. Good all around man. Can take full charge of a small plant. Best of references furnished as to ability and character. Address "A. C." care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

A position as engineer of a steam and electric plant; have been employed by a well-known Electric Mfg. Co. for the past eight years as their traveling electric expert, setting up plants all over the U. S. Have a license as engineer in Chicago. Can do any repairs about dynamos, lamps and engines. Will be open for engagement for the next 30 days. Address "Box 100," Care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

To exchange $18,000 in fruit farm and stock land, 110 miles south of St. Louis, for interest in lighting plant, by expert steam and electrical engineer, married, 36 years old, 10 years' experience; at present manager of successful plant. Address "Expert," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Best prices paid for scrap copper wire and commutator segments. Red brass wanted.
LUCIUS A. HINE & CO.,
No. 16 N. Canal St., Chicago, Ill.

WANTED.
ARMATURES TO REWIND.

Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.
HODGE, WALSH & LORING,
701 Delaware St., KANSAS CITY, MO.

FOR SALE.
Railway Generators.

Two M. P. generators 175 h. p., speed 870 revolutions for 500 volts; also 220 and 110 volt dynamos and motors, switchboards and instruments.
F. A. BAUX,
100 Chamber of Commerce, Chicago.

FOR SALE.

300 second-hand Blake transmitters complete in good order; 75 cents each in one dozen lots.
People's Telephone & Telegraph Co.,
KNOXVILLE, TENN.

ELECTROTYPES.

CHICAGO ELECTRO. & STEREO. CO.,
140-156 Plymouth Place, Chicago.

NOTICE.

NOTICE TO CONTRACTORS.—Sealed proposals for furnishing the materials and performing the labor required and necessary for installing the electric light wiring for the eastern approach, portico and lobbies, and completing the electric wiring for the western stairway and fifth story of the state library; also for furnishing the electric light fixtures for the eastern approach, lobbies, portico and western staircase, for the State Capitol at Albany, N. Y., may be sent by mail or delivered in person up to 12 o'clock noon on the 29th day of April, 1898, to the undersigned at his office in the Capitol, Albany, N. Y.

Only the bids of parties or firms actually engaged in electrical construction work and in the manufacture of electric light fixtures will be considered, and bidders must be able to refer to work similar in character, performed by them elsewhere.

Separate proposals must be made for the electric wiring and for the fixtures, and must be accompanied by a certified check or New York draft for a sum equal to ten per cent. of the amount of such proposal to guarantee execution of contract, payable at sight to the order of the Superintendent of Public Works. Said deposit will be retained as a part of the security until the completion of the contract. The amount of bond for the faithful performance of contract, or executing the contract, will be forty per cent. of the proposal or proposals, and the amount of labor bond required on execution of contract will be thirty per cent. of the proposal or proposals.

The work is to be done with all the speed compatible with good workmanship, and the contractor will be required to state the time within which they will bind themselves to complete the work, as the element of time will be considered by the Superintendent of Public Works in awarding the contract.

Drawings and specifications may be seen and blank forms of proposals obtained at the office of I. G. Perry, Capitol Commissioner, in the Capitol, at Albany, N. Y.

Original designs for electrical fixtures, together with plans and specifications and proposals for furnishing same, as substitute for designs shown as above stated, will be received and given consideration.

The undersigned reserves the right to reject any or all bids as he may deem for the best interests of the state.

GEORGE W. ALDRIDGE,
Superintendent of Public Works.

SPECIAL BARGAINS!

We have the following named high grade goods to offer:

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1 65-light 3000 c. p. Brush machine, oil cups.
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111 K-2 single T.-H. arc lamps, 2000 c. p.
2 Adams-Bagnall long-burning enclosed 110 volt arc lamps, new.
50 No. 17 double carbon Brush arc lamps, 1200 c. p. and 2000 c. p.
50 No. 17 single carbon Brush lamps, 1200 c. p. and 2000 c. p.
50 Manhattan enclosed long-burning arc lamps.
100 Adams-Bagnall open arc 2000 c. p. arc lamps.

Every machine and lamp guaranteed to be in perfect operating condition; all repaired like new.

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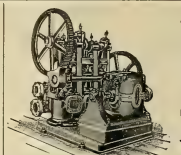

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Manufactured by
THE STILWELL-BIERCE & SMITH-VAILE CO.,
DAYTON, OHIO, U. S. A.

SEALED PROPOSALS
—FOR—
Lighting the City Natchez
WITH
ELECTRICITY.

MAYOR'S OFFICE,
NATCHEZ, MISS., April 9th, 1898.

Notice is hereby given that sealed proposals will be received at the office of the City Clerk until **Thursday, June 2nd,** at 4 o'clock p. m., for lighting the streets, alleys, parks and public buildings of this city with electricity for a term of ten (10) years, from March 1st, A. D. 1899, in accordance with plans and specifications on file in said clerk's office.

The board of mayor and aldermen reserve the right to reject any and all bids.

Specifications will be furnished parties wishing to bid, by application to the City Clerk.

Attest: W. G. BENBROOK, Clerk.
THOS. R. QUARTERMAN, Mayor.
City Clerk.

Notice to Contractors.

ST. PAUL, MINN., April 19, 1898.

Office of City Engineer,
City of Superior, West Superior, Wis.

CITY ELECTRIC LIGHTING PLANT.

Sealed proposals will be received until 11:00 A. M. of April 26, 1898, and immediately thereafter opened, for the construction and installation of a complete electric lighting plant, consisting of Boiler Plant, Compound Condensing High Speed Engines, Arc Light Dynamos, Two-Phase Generators, Condensers, Heaters, Pumps, Switchboards, etc., for a complete installation.

Copies of the plans and specifications may be seen on and after April 25th, 1898, by those desiring to submit proposals, at the office of the City Engineer, City of Superior, at the office of the consulting engineers, 511 Phoenix Building, St. Paul, Minn., or at 304 Manhattan Building, St. Paul, Minn. Synopsis of specifications can be had on application. Each bid must be accompanied by a certified check for a sum not less than 3 per cent. of the amount of the proposal, made out to the order of the Treasurer of the City of Superior.

The city reserves the right to reject any or all bids, and to waive any defects or formalities in any bid should it be deemed to the interest of the city to do so. All bids received after the time stated will be returned unopened.

FRED A. GRAHAM,
Chairman Lighting Committee.

WANTED.

A 300 to 400 horse power high-speed automatic engine with double flywheel, twenty to twenty-four inch face; tandem compound preferred. Address **Economy Light and Power Co., Joliet, Ill.,** immediately, stating lowest price f. o. b. cars point of delivery.

FOR SALE.

One 12"x12" "Erie" automatic engine, used about nine months.
One 14"x16"x12" "Deane" Duplex steam pump.
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Is the Only Double Adjustment Bell That
Cannot Get Out Of Adjustment.
PROCTOR-RAYMOND MFG. CO.,
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PLATINUM REFINERS,
63 Washington Street, Chicago, Ill.
Highest Cash Price Paid for Platinum Scrap.
Platinum Wire and Plate For Sale.

Second-Hand Engines.

for sale cheap by **The American Engine Co.,** builders of the American-Ball Engines and Electrical Machinery, Bound Brook, N. J.

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BARGAINS IN DYNAMOS AND ENGINES.

Direct Current Dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,330, 1,610 and 2,500 lights capacity; Alternating Current Dynamos of 750, 900, 1,300 and 2,000 lights capacity; Arc Dynamos, 20, 24, 30, 40, 50 and 60 lights, both 1,200 and 2,000 c. p.; Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 h. p.; Boilers, 100, 250, 375 and 500 b. p.; Heaters, 150, 1,000 and 2,000 h. p.; Pumps, all sizes. Most of this apparatus has been in use in our own stations, and we, therefore, know its exact history, and can state that it is in thoroughly good operative condition. *Write for Price List No. 22.*

CHICAGO EDISON COMPANY,
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If you have any **Old Copper Wire** of any description to dispose of, it will pay you to communicate with us, as we are at all times in the market for any quantity of **Scrap Copper Wire,** at the highest market values. We pay cash and send prompt returns. We are also supplying the electrical trade with our high grade **Babbitt, Cotton Waste, Solder, Etc.** Please communicate with us.

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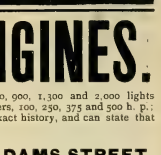

NORTHERN ELECTRICAL MFG. CO.,
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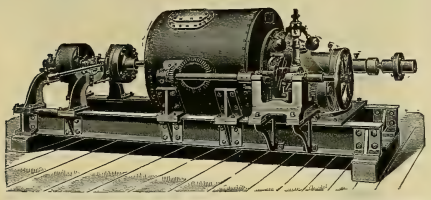
Victor Turbine Water Wheel.



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The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 30 H. P. under 88 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts and where the situation admits of their use we recommend them.

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Patented Telephony.
A review of patents pertaining to Telephones and Telephonic Apparatus by the
American Electrical Engineering Association.

CONTENTS: Introductory.—Percentage of Patents Sustained.—Supreme Court Decisions.—Berliner Case.—Induction Coil.—Drawbaugh Cases.—Hunnings Transmitter.—Subscribers' Calls.—Switchboards.—Law System.—Manu System.—Multiple Board.—Express System.—Raverot Hess System.—Comparative Advantages, Multiple and Divided Board Systems.—Carney Plug Board.—Brief Mention.—Automatic Switchboards.—Conclusions.—Index.

ILLUSTRATIONS:
Patent of A. G. Bell, No. 174,465. Patent of Emile Berliner, No. 233,969. Patent of Emile Berliner, No. 463,569. Patents of Emile Berliner in Parallel Columns. Patent of C. A. Cheever, No. 208,863. Patent of H. H. Eldred, No. 203,744. Patent of Thos. A. Watson, No. 256,258. Patent of L. B. Firman, No. 283,334. Patent of M. G. Kellogg, No. 297,199. Patent of C. E. Scribner, No. 230,058. Patent of C. E. Scribner, No. 200,044. Trunking Principle. Patent of Shaw & Childs, No. 379,856. Manu System. Patent of L. B. Firman, No. 272,576. Western Union Pin Switch. Express System. Patent of Sabin & Hampton, No. 343,541. Subscriber's Automatic Signal. Raverot-Hess System. Patent of M. J. Carney, No. 258,886. Apostoloff System.

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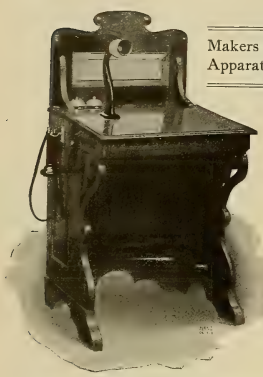

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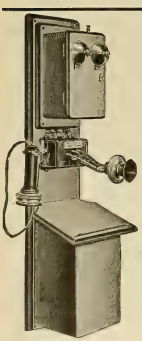

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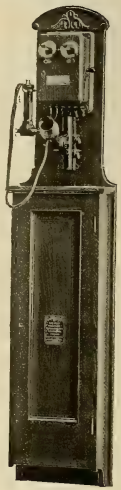

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4. The Microphone.
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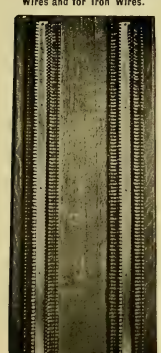

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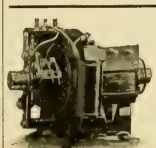

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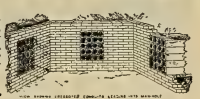

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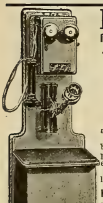

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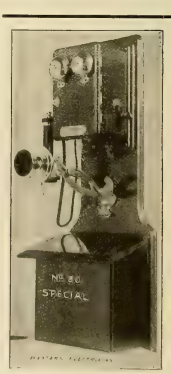

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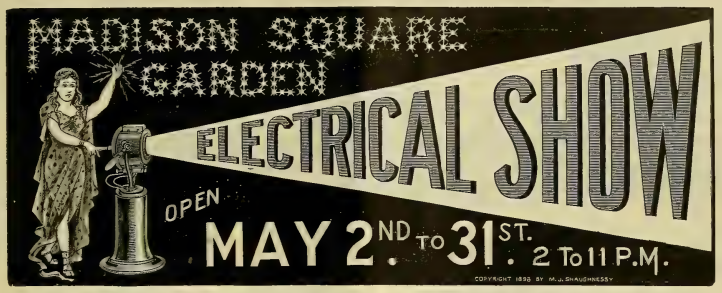

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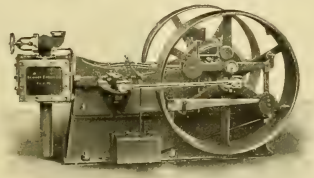

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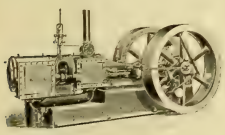

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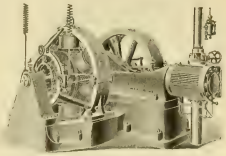

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⅞	15.04	138.12	155.93	223.61	84.55
¾	15.11	127.67	133.24	191.06	83.68
⅝	15.88	111.50	111.65	162.80	80.55
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Test of a 35 inch SAMSON, Feb. 1, '97.

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Full	15.29	194.25	102.09	143.44	81.08
⅞	16.56	187.75	92.15	146.72	84.78
¾	17.33	178.50	83.95	138.40	83.88
⅝	17.34	176.40	68.81	109.64	80.09
½	17.68	168.50	57.69	88.14	79.09

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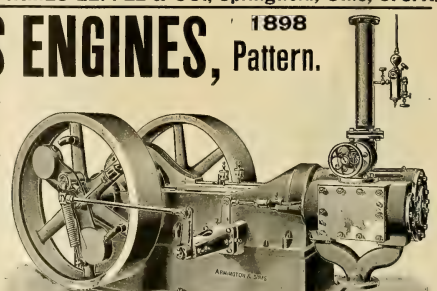

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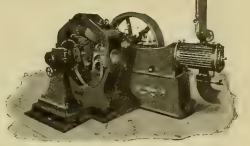

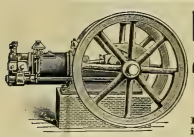

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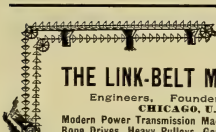

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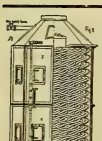

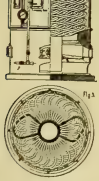

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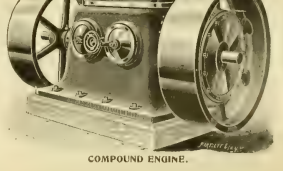

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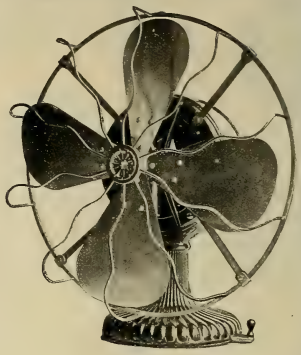

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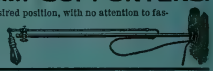
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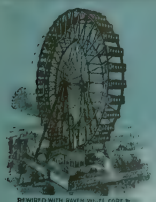
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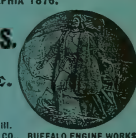

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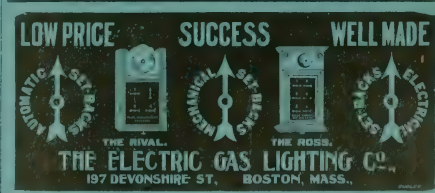

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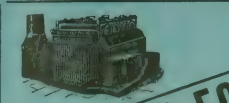

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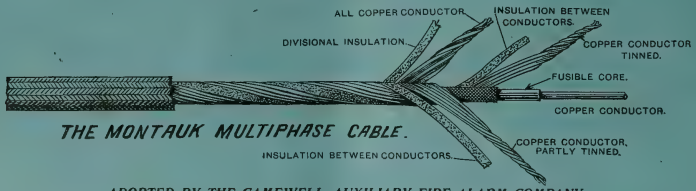

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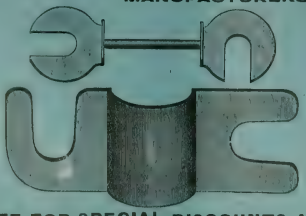

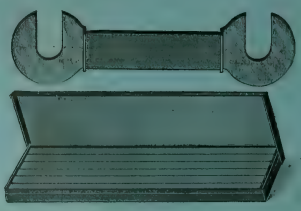

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In the West. **ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.**

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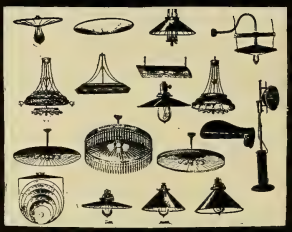

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" " " 250 " - - -	18.00
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Empire " " 115 " - - -	22.00

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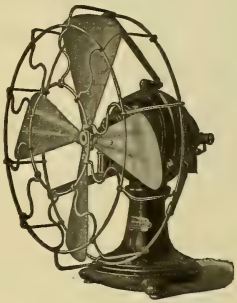

560 A. 12 Inch Fan.
562 S. 16 " "

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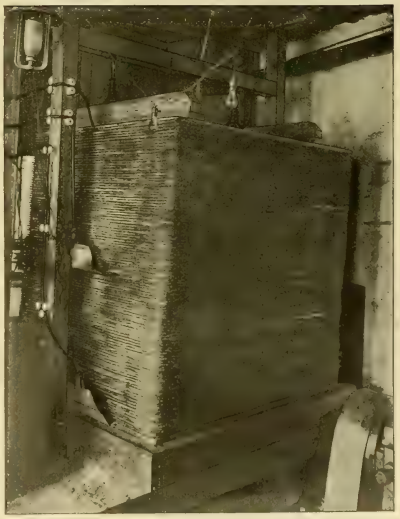

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Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights,

It Is Positive in Its Action.

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Approved by the National Fire Underwriters' Association.

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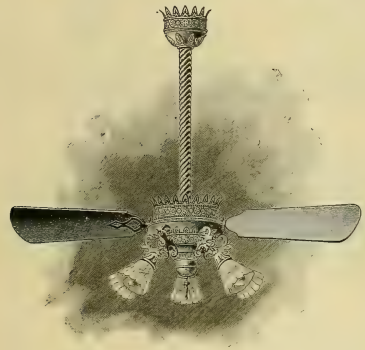

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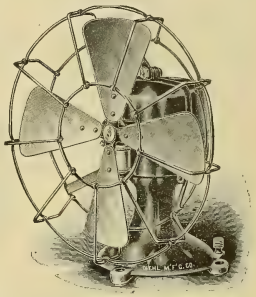

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Good Ventilation,
Light Weight,
High Efficiency,
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Convenient to Install.

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No Commutator,
No Moving Wire,
Simplicity,
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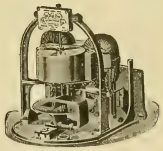
Even to a 6 c. p. Light.



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The Best System of Belting in the World

Compared with Straight Belts - - { Easier on bearings, Smaller per cent. of slip, One-half the space.

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The Zamel Arc Light Meter

AND ELECTRIC CURRENT TIMER

Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights,

It Is Positive in Its Action.

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- Leclanche Battery Co., The
- National Carbon Co.
- Partrick, Carter & Wilkins.
- Peru Elec. Mfg. Co.
- Reliable Elec. Supply Co.
- Western Electric Co.

Bells.
- Central Electric Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Huebel & Manger.
- Illinois Electric Co.
- Partrick, Carter & Wilkins.
- Proctor-Raymond Mfg. Co.
- Reliable Elec. Supply Co.
- Western Electric Co.

Belting.
- Link Belt Machinery Co.
- L. P. & D. Transmitter Co.
- Main Belting Co.
- Peerless Rubber Mfg. Co.
- Shultz Belting Co.

Boilers.
- Ames Iron Works.
- Armington & Sims Co.
- Clonbrook Steam Boiler Co.
- Westinghouse, Church, Kerr & Co.

Books, Electrical.
- Electrician Publishing Co.

Brass Founders and Finishers · Metal Patterns
- Moser & Wilson.

Bridges, Floors, Cranes.
- Berlin Iron Bridge Co.

Brushes.
- Central Electric Co.
- Commercial El. Supply Co.
- Holmes Fibre-Graphite Co.
- K. & W. Company.
- Ohio Elec. Specialty Mfg. Co.
- Partridge Carbon Co.

Buildings and Roofing.
- Berlin Iron Bridge Co.

Burglar Alarms.
- Central Electric Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Huebel & Manger.
- Partrick, Carter & Wilkins.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
- American Elec. Works.
- Brixey, W. R.
- Central Electric Co.
- Commercial El. Supply Co
- Eastern Electric Cable Co.
- General Electric Co.
- Illinois Electric Co.
- Moore, Alfred F.
- New York Ins. Wire Co.
- Reliable Elec. Supply Co.
- Simplex Electrical Co.
- Standard Underground C. Co.
- Washburn & Moen Mfg. Co.

Carbons, Points & Plates.
- Central Electric Co.
- Chicago Edison Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Gen'l Inc. Arc Light Co
- Illinois Electric Co.
- National Carbon Co.
- Partridge Carbon Co
- Reisinger, Hugo.
- Schiff, Jordan & Co.

Compound.
- Atlantic Alcatraz Asph. Co.
- Boiler Expurgator Co.
- Central Electric Co.
- Dearborn Drug & Chem. Wks
- Electric Appliance Co.
- K. & W. Company.
- Mass. Chemical Co.
- McLennan & Co., K.
- Ohio Elec. Specialty Mfg. Co.
- Reliable Elec. Supply Co.
- Standard Paint Co.
- Western Electric Co.

Conduit and Conduits.
- Central Electric Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Michigan Pipe Co.

Construction & Repairs.
- Akron Elec. Mfg. Co.
- Bullock Elec. Mfg. Co.
- Central Electric Co.
- Chicago Edison Co.
- Ft. Wayne Elec. Corporation.
- Hodge, Walsh & Loring.
- McRae, A. L.
- Morrell Electric Works.
- Sargent & Lundy.
- United Elec. Imp. Co.
- Wagner Elec. Mfg. Co.
- Walker Company.
- Western Electric Co.

Contractors and Electric Light Plants.
- Akron Elec. Mfg. Co.
- Bain, Foree.
- Broughton, H. P.
- Bullock Elec. Mfg. Co.
- Card Electric Co.
- Central Electric Co.
- Commercial El. Supply Co.
- Diehl Mfg. Co.
- Eddy Elec. Mfg. Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- McRae, A. L.
- Meysenburg & Badt.
- Northern Electl. Mfg. Co.
- Sargent & Lundy.
- United Elec. Imp. Co.
- Wagner Elec. Mfg. Co.
- Walker Company.
- Western Electric Co.
- Westinghouse Elec & Mfg Co.

Conveyors.
- Link-Belt Machinery Co.

Copper.
- Besly & Co., Chas. H.
- Mansfield Temp. Copper Co.
- Mitchell Temp. Copper Co.

Copper Wires.
- American Electrical Works.
- Besly & Co., Chas H.
- Brixey, W. R.
- Central Electric Co.
- Chicago Edison Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- General Electric Co.
- Illinois Electric Co.
- National India Rubber Co.
- Okonite Co., The.
- Phillips Insulated Wire Co.
- Roebling's Sons. Co., J. A.
- Simplex Electrical Co.
- Standard Underground C. Co.
- Washburn & Moen Mfg. Co.

Cordage.
- Samson Cordage Wks.

Correspondence Schools.
- Elec. Engineer Corr. Inst.
- Int. Correspond. Schools.

Crookes' Tubes.
- Central Electric Co.
- Commercial El. Supply Co.

Cross-Arms, Pins and Brackets.
- Bally Mfg. Co.
- Brady, T. H.
- Central Electric Co.
- Central Mfg. Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Electric Ry. Equipment Co.
- Farr Tel. & Cons. Sup. Co.
- Michigan Pipe Co.

Cut-Outs and Switches.
- Automatic Switch Co.
- Bossert Elec. Const. Co.
- Central Electric Co.
- Chicago Edison Co.
- Commercial El. Supply Co.
- Cutter El. & Mfg. Co.
- Eddy Elec. Mfg. Co.
- Electric Appliance Co.
- Emerson El. Mfg. Co.
- General Elec. Co.
- Hart & Hegeman Mfg. Co.
- Hill, W. S. Electric Co.
- Illinois Electric Co.
- K. & W. Company.
- Leonard, H. Ward Elec. Co.
- Paiste Co., H. T.
- Peoples Electric Co.
- Peru Elec. Mfg. Co.
- Phila. Elec. & Mfg. Co.
- Reliable Elec. Supply Co.
- Wagner Elec. Mfg. Co.
- Walker Company.
- Western Electric Co.
- Westinghouse El. & Mfg. Co.

Dynamos.
- Akron Elec. Mfg. Co.
- American Engine Co.
- Bullock Elec. Mfg. Co.
- Card Electric Co.
- Central Electric Co.
- Commercial El. Supply Co.
- Diehl Mfg. Co.
- Eddy Elec. Mfg. Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Hobart Elec Mfg. Co
- Northern Electl. Mfg. Co.
- Nott & Co., A. D.
- Sargent & Lundy.
- Sprague Electric Co.
- United Elec. Imp. Co.
- Wagner Elec. Mfg. Co.
- Walker Company.
- Warner Co., Wm. F.
- Western Electric Co.
- Westinghouse El. & Mfg. Co.

Economizers, Fuel.
- Broomell, Schmidt & Co.
- Fuel Economizer Co.

Elec. Heat'g Appliances.
- American Elec. Heater Co.

Electric Meters.
- American El. Meter Co.
- Zamel Arc Light Meter Co.

Electric Railways.
- General Electric Co.
- Sprague Electric Co.
- Walker Company.
- Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
- Bain, Foree.
- Broughton, H. P.
- McRae, A. L.
- Meysenburg & Badt.
- Sargent & Lundy.
- Westinghouse, Church, Kerr & Co.

Electrical Instruments.
- Belknap Motor Co
- Central Electric Co.
- Cherry Electric Works.
- Commercial El. Supply Co.
- Cutter El. & Mfg. Co.
- Electric Appliance Co.
- Emerson El. Mfg. Co.
- General Electric Co.
- Hill, W. S. Electric Co.
- Illinois Electric Co.
- Keystone El. Instrument Co.
- Leonard, Ward, Elec. Co.
- Paiste Co., H. T.
- Queen & Co.
- Wagner Elec. Mfg. Co.
- Western Electric Co.
- Weston Electrical Inst. Co.

Electrical Specialties.
- Central Electric Co.
- Commercial El. Supply Co.
- Hill, W. S. Electric Co.
- Ohio Elec Specialty Mfg. Co.
- Pacific Electric Co.
- Paiste Co., H. T.
- Peru Elec. Mfg. Co.

Electro-Magnets.
- Varley Duplex-Magnet Co.

Electro-Plating Mach'y.
- Besly & Co., Chas. H.
- General Electric Co.
- Hobart Elec. Mfg. Co.
- Nott & Co., A. D.

Enamel.
- Sanitary Mfg. & Enamel. Co.

Engines, Gas.
- Foos Gas Engine Co.
- Otto Gas Engine Wks.
- Wolverine Motor Works.

Engines, Steam.
- American Engine Co.
- Ames Iron Works.
- Armington & Sims Co.
- Ball Engine Co.
- Skinner Engine Co.
- Westinghouse, Church, Kerr & Co.

Fan Outfits.
- Bates & Bro., D. L.
- Central Electric Co.
- Commercial El. Supply Co.
- Diehl Mfg. Co.
- Edison Mfg. Co.
- Emerson El. Mfg. Co.
- Farr Tel. & Cons. Sup. Co.
- General Electric Co.
- Illinois Electric Co.
- Marietta Mfg. Co.
- Schneider Mfg. Co.
- Specialty Mfg. Co.
- Sprague Electric Co.
- Wagner Electric Mfg. Co.
- Walker Company.
- Western Electric Co.
- Westinghouse El. & Mfg. Co.

Fibre.
- Delaware Hard Fibre Co.
- Diamond State Fibre Co.
- Kartavert Mfg. Co.
- Vulcanized Fibre Co.

Files.
- Barnett Co., G. & H.

Fixtures, El. & Comb'n.
- Central Electric Co.
- Commercial El. Supply Co.

Flexible Shafts.
- Stow Mfg. Co.

Fuses.
- American Elec. Fuse Co,

Fuse Wire.
- American Elec. Fuse Co.
- Central Electric Co.
- Commercial El. Supply Co.
- Electric Appliance Co.

Gaskets.
- Link-Belt Machinery Co.
- Peerless Rubber Mfg. Co.

Gas Lighting, Electric.
- Central Electric Co.
- Partrick, Carter & Wilkins.
- Western Electric Co.

Gears.
- Besly & Co., Chas. H.
- Link-Belt Machinery Co.
- Pratt & Whitney Co.

General Elec. Supplies.
- Ansonia Electrical Co
- Besly & Co., Chas. H.
- Central Electric Co.
- Chicago Edison Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Electric Ry. Equipment Co.
- General Electric Co.
- Hodge, Walsh & Loring.
- Hill, W. S. Electric Co.
- Illinois Electric Co.
- K. & W. Company.
- Paiste Co., H. T.
- Partrick, Carter & Wilkins.
- Peru Elec. Mfg. Co.
- Reading Elec. Mfg. Co.
- Reliable Elec. Supply Co.
- Western Electric Co.

Globes and Electrical Glassware.
- Central Electric Co.
- Commercial El. Supply Co.

Gov'nors, Water Wheel.
- Lombard Water Wheel Gv. Co.

Graphite Specialties.
- Besly & Co., Chas. H.
- Dixon Crucible Co., Jos.
- Holmes Fibre-Graphite Co.

Hanger Boards.
- K. & W. Company.

Induction Coils.
- Queen & Co.

Insulators and Insulating Materials.
- Ansonia Electrical Co.
- Atlantic Alcatraz Asph. Co.
- Brixey, W. R.
- Central Electric Co.
- Chicago Edison Co.
- Commercial El. Supply Co.
- Delaware Hard Fibre Co.
- Diamond State Fibre Co.
- Electric Appliance Co.
- Emerson El. Mfg. Co.
- Empire China Works.
- Hill, W. S. Electric Co.
- Illinois Electric Co.
- Kartavert Mfg. Co.
- K. & W. Company.
- Leonard, H. Ward Elec. Co.
- Mass. Chemical Co.
- Mica Insulator Co.
- National India Rubber Co.
- New York Insulated Wire Co.
- Okonite Co., The.
- Paiste Co., H. T.
- Peru Elec. Mfg. Co.
- Phillips Insulated Wire Co.
- Reliable Elec. Supply Co.
- Simplex Electrical Co.
- Standard Paint Co.
- Standard Underground C. Co.
- Vulcanized Fibre Co.
- Wagner Elec. Mfg Co.
- Western Electric Co.

Insulated Wires and Cables—Magnet Wires.
- American Electrical Works.
- Brixey, W. R.
- Central Electric Co.
- Chicago Edison Co.
- Chicago Ins. Wire Co.
- Commercial El. Supply Co.
- Eastern Electric Cable Co.
- Electric Appliance Co.
- General Electric Co.
- Illinois Electric Co.
- Montauk Multiph. Cable Co.
- Moore, Alfred F.
- National India Rubber Co.
- New York Insulated Wire Co.
- Okonite Co., The.
- Phillips Insulated Wire Co.
- Reliable Elec. Supply Co.
- Roebling's Sons Co., J. A.
- Simplex Electrical Co.
- Standard Underground C. Co.
- Washburn & Moen Mfg. Co.
- Western Electric Co.

Junction Boxes.
- Bossert Elec. Const. Co.
- Leonard, H. Ward Elec. Co.

Lamp Adjusters.
- Faries Mfg. Co.
- White Co., O. C.

Lamps, Incandescent.
- Buckeye Electric Co.
- Central Electric Co.
- Chicago Edison Co.
- Commercial El. Supply Co.
- Electrical Exchange.
- Electric Appliance Co.
- General Electric Co.,
- Illinois Electric Co.
- Jersey Electric Co.
- K. & W. Company.
- Lynn Incandescent Lp. Co.
- Reliable Elec. Supply Co.
- Sawyer-Man Elec. Co.
- United Elec. Imp. Co.
- Western Electric Co.
- Westinghouse El. & Mfg. Co.

Lightning Arresters.
- Central Electric Co.
- Electric Appliance Co.
- General Electric Co.
- Westinghouse El. & Mfg. Co.

Magnet Wire.
- (See Insulated Wires.)

Mechanical Machinery.
- American Tool Works Co.
- Besly & Co., Chas. H.
- Link-Belt Machinery Co.
- Pratt & Whitney Co,
- Sibley & Ware.
- Stilwell-Bierce Smith-Vaile
- Westinghouse, Church, Kerr & Co.

Mica.
- Central Electric Co.
- Commercial El. Supply Co.
- Munsell & Co., Eugene.
- Schoonmaker, A. O.

Mining Apparatus, Elec.
- General Electric Co.
- Link-Belt Machinery Co.
- Westinghouse El. & Mfg. Co.

Motors.
- Akron Elec. Mfg. Co.
- American Engine Co.
- Belknap Motor Co.
- Bullock Elec. Mfg. Co.
- Card Electric Co.
- Central Electric Co.
- Commercial El. Supply Co.
- Diehl Mfg. Co.
- Eddy Elec. Mfg. Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Hobart Elec. Mfg. Co.
- Northern Electl. Mfg. Co.
- Sargent & Lundy.
- Sprague Electric Co.
- Stanley Elec. Mfg. Co.
- United Elec. Imp. Co.
- Wagner Elec. Mfg. Co.
- Walker Company.
- Western Electric Co.
- Westinghouse El. & Mfg. Co.

Packing.
- Besly & Co. Chas. H.
- Garlock Packing Co.
- Link-Belt Machinery Co.
- Peerless Rubber Mfg. Co.

Paints.
- Atlantic Alcatraz Asph. Co.
- Central Electric Co.
- Commercial El. Supply Co.
- Mass. Chemical Co.
- Standard Paint Co.

Phosphor Bronze.
- Besly & Co., Chas. H.
- Phosphor Bronze Sm. Co. Ltd.

Platinum.
- Baker & Co.

Poles.
- Baily Mfg. Co.
- Berthold & Jennings.
- Central Mfg Co.
- Electric Ry. Equipment Co.
- Lindsley Bros.
- Michigan Pipe Company.
- Perrizo & Sons.
- Pittsb & L. Sup. Iron Co.
- Stone Lumber Co.
- Torrey Cedar Co.
- Valentine-Clark Co.

Porcelain.
- Central Electric Co.
- Commercial El. Supply Co.
- Empire China Works.
- Peru Elec. Mfg. Co.

Refiners.
- Goldsmith Bros.
- Swarts Metal Refining Co.

Reflectors.
- Amer. Reflector & Ltg. Co.

Re-Winding—Repairs.
- Chicago Armature Co.
- Chicago Edison Co.
- Hodge, Walsh & Loring.
- Morrell Electric Works.
- Utica Elec Mfg. & Sup. Co.

Rheostats.
- American Rheostat Co.
- Automatic Switch Co.
- Cutler-Hammer Mfg. Co.
- General Electric Co.
- Leonard, Ward, Electric Co.
- Ohio Elec. Specialty Mfg. Co.
- Westinghouse El. & Mfg. Co.

Roofing.
- Cincinnati Corrugating Co.

Second-Hand Machin'y.
- Cornman Co.
- Electrical Exchange.
- Hine & Co., L. A.
- Hodge, Walsh & Loring.

Shades.
- Amer. Reflector & Ltg. Co.
- Faries Mfg. Co.

Spark Arresters.
- K. & W. Company.

Speaking Tubes.
- Central Electric Co.
- Electric Appliance Co.
- Partrick, Carter & Wilkins.
- Western Electric Co.

Speed Indicators.
- Besly & Co., Chas. H.
- Keystone El. Instrument Co.
- Queen & Co.
- Weston Electrical Inst. Co.

Steel Boxes.
- Bossert Elec. Const. Co.

Storage Batteries.
- American Battery Co.
- Electric Storage Battery Co.
- High Tension El. Stor. Co.

Street Cars.
- Stephenson Co., John.

Tapes, Insulating.
- American Electrical Works.
- Brixey, W. R.
- Central Electric Co.
- Chicago Ins. Wire Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Illinois Electric Co.
- Moore, Alfred F.
- New York Insulated Wire Co
- Okonite Co., The.
- Reliable Elec. Supply Co.
- Simplex Electrical Co.
- Standard Paint Co.
- Washburn & Moen Mfg. Co.
- Western Electric Co.

Telephones, Telephone Material and Switchboards.
- American El. Telephone Co.
- Bissell & Co., F.
- Cabinet Mfg. Co.
- Central Electric Co.
- Commercial El. Supply Co
- Farr Tel. & Cons. Sup. Co.
- Holtzer-Cabot Electric Co.
- Keystone Tel. Co.
- Kokomo Tel. & El. Mfg. Co.
- Kusel, D. A. Tel. & El. Mfg. Co.
- Mason Tel. Pay Station Co.
- McDerm'd Mfg. Co.
- Mianus Electric Co.
- Northwest Engineering Co.
- N. W. Tel. Mfg. Co.
- Rawson Electric Co.
- Reading Elec Mfg. Co.
- Standard Tel. & El. Co.
- Sterling Electric Co
- Stromberg-Carlson Tl. M. Co.
- Viaduct Mfg. Co.
- Western Electric Co.
- Western Tel. Cons. Co.

Tools.
- American Tool Works Co.
- Klein & Son, Mathias.

Transformers.
- Central Electric Co.
- Commercial El. Supply Co.
- Diamond Elec. Co.
- Ft. Wayne Elec. Corporation.
- General Electric Co.
- Stanley Electric Mfg. Co.
- Wagner Elec. Mfg. Co.
- Walker Company.
- Western Electric Co.
- Westinghouse El. & Mfg. Co

Trolley Cord.
- Samson Cordage Wks.

Trucks, Electric Car.
- General Electric Co.
- Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
- Am. Impulse Wheel Co.
- Dayton Globe Iron Works Co
- Leffel & Co., Jas.
- Pelton Water Wheel Co.
- Stilwell-Bierce Smith-Vaile.

Vulcanized Fibre.
- Vulcanized Fibre Co.

Wire, Bare.
- Besly & Co., Chas. H.
- Brixey, W. R.
- Central Electric Co.
- Commercial El. Supply Co.
- Electric Appliance Co.
- Okonite Co., The.
- Phillips Insulated Wire Co.
- Roebling's Sons Co., J. A.
- Standard Underground C. Co
- Washburn & Moen Mfg. Co.
- Western Electric Co.

Woodwork, Electrical.
- Cabinet Mfg. Co.

X Ray Outfits.
- Central Electric Co.
- Commercial El. Supply Co
- Queen & Co.

DIEHL FANS

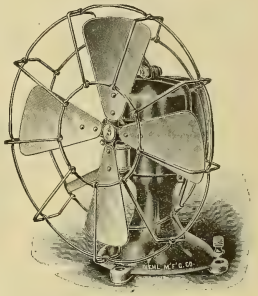
FOR ALL CIRCUITS, EXCEPT ALTERNATING.

OUR CEILING FANS AND ELECTROLIERS
ARE THE

Recognized Standard
OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency
Of Any on the Market.



WRITE FOR CIRCULARS AND PRICES
ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway.
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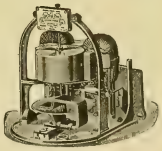
DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

TRANSFORMERS-WATTMETERS.

(SCHEEFFER'S IMPROVED.)

Double Primary Coils.
Double Secondary Coils.
Good Ventilation.
Light Weight.
High Efficiency.
Good Regulation.
Small Iron Loss.
Convenient to Install.

No Brushes.
No Commutator.
No Moving Wire.
Simplicity.
Durability.
Reliability.
Accuracy.
Even to a 6 c. p. Light.



DIAMOND ELECTRIC CO.,
MANUFACTURERS,

Office: 1202 Fisher Building, Chicago, Ill. Factory: Peoria, Ill.

The Best System of Belting in the World

Compared with Straight Belts - - { Easier on bearings, Smaller per cent. of slip, One-half the space.

Compared with Clutches - - - - { Less expense, More efficient in operation, Great saving in space.

Compared with Direct Coupling - { About the same floor space, Cost much smaller, Easier to keep in repair.

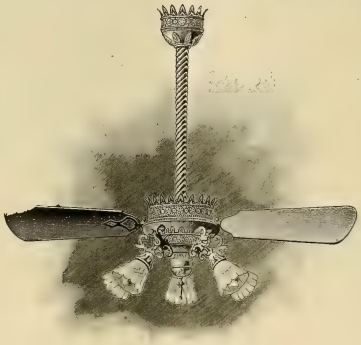
Write for Further Particulars.

D & W NON ARCING FUSES D & W

Diehl Direct Current

Westinghouse Alternating

FANS



WESTERN AGENTS

Commercial Electrical Supply Company,

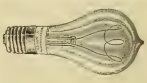
ST. LOUIS.

Sawyer-Man Incandescent Lamps.

D & W NON ARCING FUSES D & W

General Electrical Supplies.

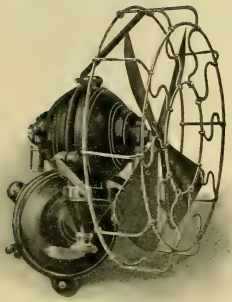
CHICAGO AGENTS



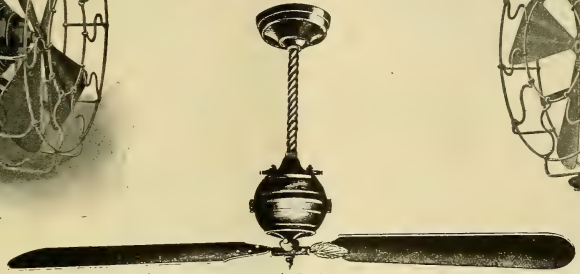
For '98 LUNDELL FANS!

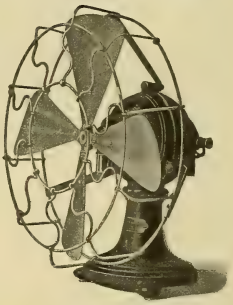
560 A. DESK FAN, - $10.50
562 S. " " - - 13.50

560 B. BRACKET, - $10.50
564 B. " - - 13.50



560 B.





560 A.

SENIOR—110 Volts, $17.50; 250 Volts, $18.00; 500 Volts, $23.50. | EMPIRE—Fan only 110 Volts, $22.00.

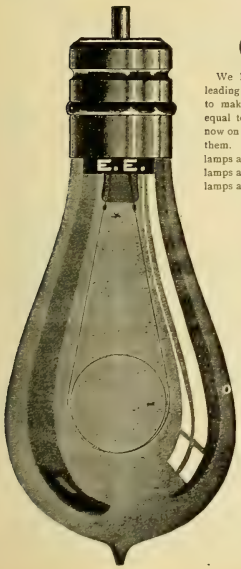
5 PER CENT. DISCOUNT IN DOZEN LOTS.

Illinois Electric Co., 239 Madison St., Chicago.

Frank E. Healy, President. Lemuel K. Cushing, Secretary. Carl Keith, Treasurer.

A Strictly High-Grade Lamp

15 CENTS.



We have just arranged with one of the leading manufacturers of incandescent lamps to make for us a strictly high-grade lamp, equal to any of the so-called "Trust" lamps now on the market, and superior to many of them. For the next 60 days we offer these lamps at 15 cents each, in barrel lots. These lamps are fully guaranteed. We sell refilled lamps at 13 cents each. Give us a trial order.

New Midget Upton 150-Hour Arc Lamp for 110-Volt Circuit, $15.00
For Alternating Circuit, 20.00

A full line of Electrical Supplies carried in stock. Lowest possible prices.

2¼-Inch Shade Holders, per doz., 25c.
Edison Wiring Receptacles, each, 4c.
Climbers, per pair, - - - 75c.
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MANY KINDS FOR ALL DEMANDS.

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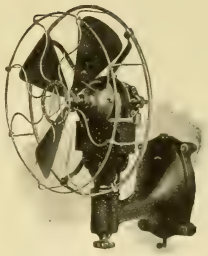

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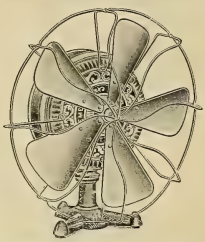

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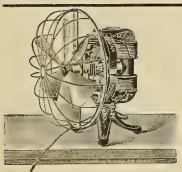

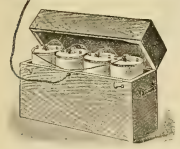

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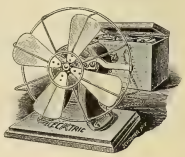

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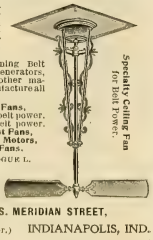

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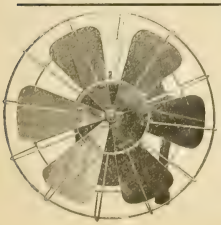

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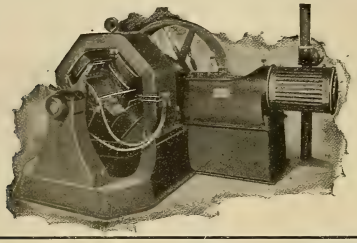

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We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

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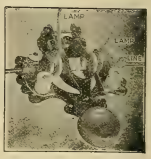

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and that said businesses will be continued by us without interruption. The same favors heretofore extended to them are solicited by us as their successors.

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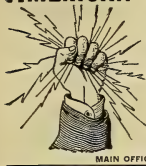

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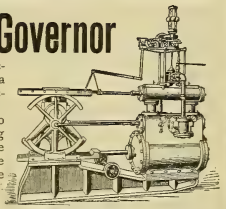

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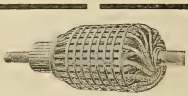

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111 K-2 single T.-H. arc lamps, 2000 c. p.
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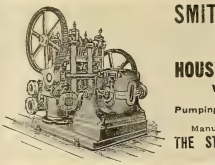

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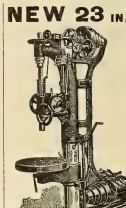

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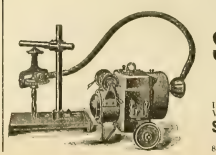

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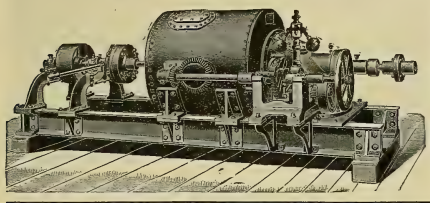

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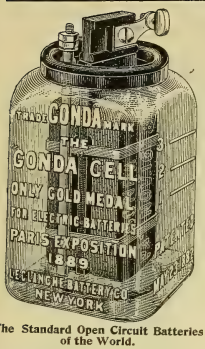

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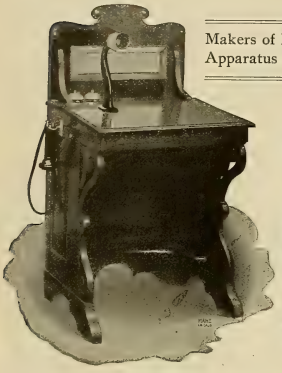

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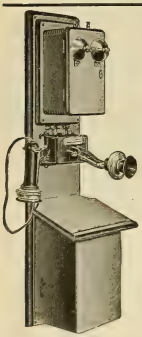

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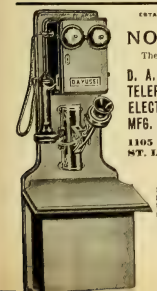

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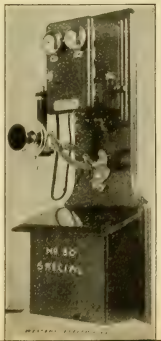

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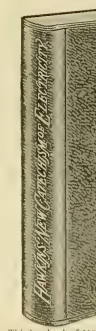

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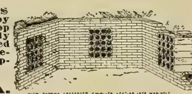

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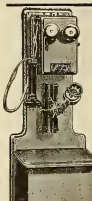

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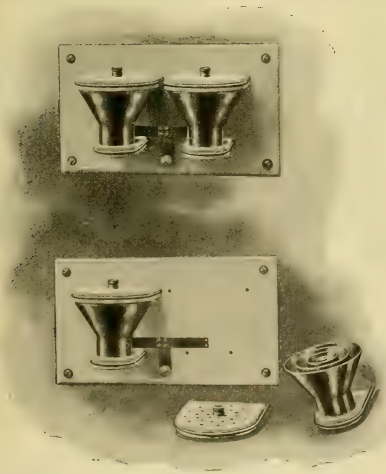

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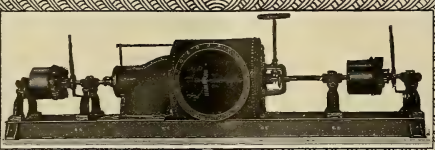

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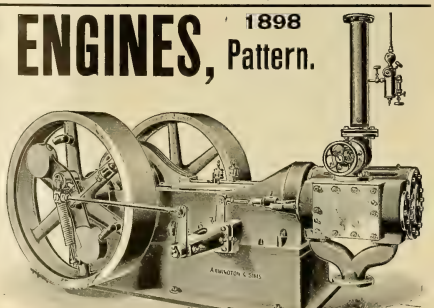

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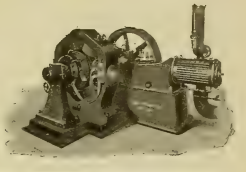

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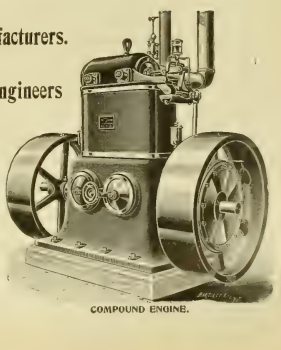

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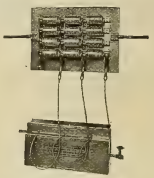

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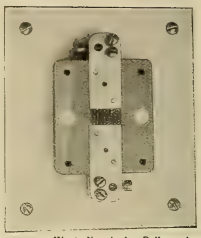

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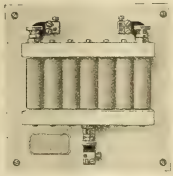

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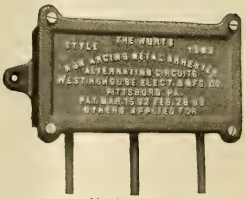

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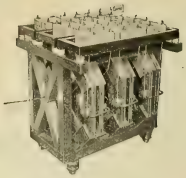

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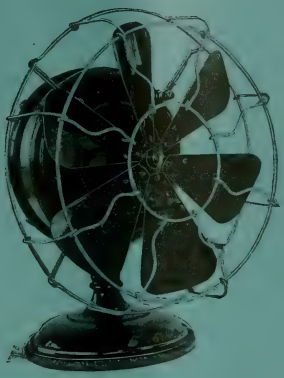

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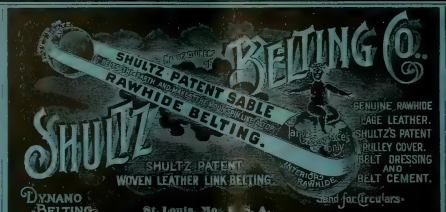

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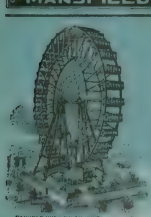

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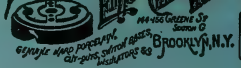

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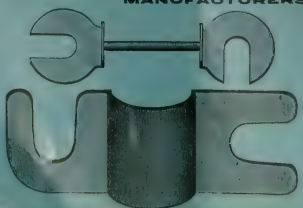

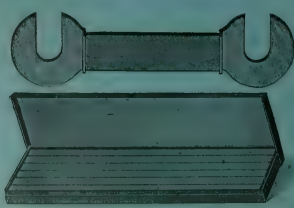

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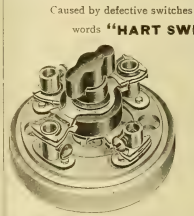

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McRae, A. L.
Morrell Electric Works.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Commercial El. Supply Co.
Edison Mfg. Co.
Electric Appliance Co.
Elec. Gas Lighting Co.
Gordon-Burnham Battery Co
Illinois Electric Co.
Leclanche Battery Co., The
National Carbon Co.
Partrick, Carter & Wilkins.
Peru Elec. Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.

Bells.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Huebel & Manger.
Illinois Electric Co.
Partrick, Carter & Wilkins.
Proctor-Raymond Mfg. Co.
Reliable Elec. Supply Co.
Western Electric Co.

Belting.
Link Belt Machinery Co.
L. P. & B. Transmitter Co.
Main Belting Co.
Munson, Chas. Belting Co.
Peerless Rubber Mfg. Co.
Shultz Belting Co.

Boilers.
Ames Iron Works.
Armington & Sims Co.
Clonbrook Steam Boiler Co.
Westinghouse, Church, Kerr & Co.

Books, Electrical.
Electrician Publishing Co.

Brass Founders and Finishers. Metal Patterns
Moser & Wilson.

Bridges, Floors, Cranes.
Berlin Iron Bridge Co.

Brushes.
Central Electric Co.
Commercial El. Supply Co.
Holmes Fibre-Graphite Co.
K. & W. Company.
Ohio Elec. Specialty Mfg. Co.

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Berlin Iron Bridge Co.

Burglar Alarms.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Huebel & Manger.
Partrick, Carter & Wilkins.

Cables (See Insulated Wires.)
Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
General Electric Co.
Illinois Electric Co.
Moore, Alfred P.
New York Ins. Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Underground C. Co
Washburn & Moen Mfg. Co.

Carbons, Points & Plates.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
Gen'l Inc. Arc Light Co.
Illinois Electric Co.
National Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.

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Atlantic Alcatraz Asph. Co.
Boiler Expurgator Co.
Central Electric Co.
Dearborn Drug & Chem. Wks
Electric Appliance Co.
K. & W. Company.
Mass. Chemical Co.
McLennan & Co., K.
Ohio Elec. Specialty Mfg. Co.
Reliable Elec. Supply Co.
Standard Paint Co.
Western Electric Co.

Conduit and Conduits.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Michigan Pipe Co.

Construction & Repairs.
Akron Elec. Mfg. Co.
Bullock Elec. Mfg. Co.
Central Electric Co.
Chicago Edison Co.
Ft. Wayne Elec. Corporation.
Hodge, Walsh & Loring.
McRae, A. L.
Morrell Electric Works.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
McRae, A. L.
Meyenburg & Badt.
Northern Electl. Mfg. Co.
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec & Mfg Co.

Conveyors.
Link-Belt Machinery Co.

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Brady & Co., Chas. H.
Mansfield Tomp. Copper Co.
Mitchell Tomp. Copper Co.

Copper Wires.
American Electrical Works.
Brady & Co., Chas H.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
National India Rubber Co.
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.

Cordage.
Samson Cordage Wks.

Correspondence Schools.
Elec. Engineering Inst.
Ls. Correspond. Schools.

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Commercial El. Supply Co.

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Brady, T. H.
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Central Mfg. Co.
Commercial El. Supply Co.
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Peru Elec. Mfg. Co.
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Peru Elec. Mfg. Co.
Philo, Elec. & Mfg. Co.
Reliable Elec. Supply Co
Warner Elec. Mfg. Co.
Walker Company.
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Westinghouse El. & Mfg. Co.

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American Engine Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co
Northern Electl. Mfg. Co.
Nott & Co., A. D.
Sargent & Lundy.
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United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warner Co., Wm. F.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Broomell, Schmidt & Co.
Fuel Economizer Co.

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American Elec. Meter Co.
Zamel Arc Light Meter Co.

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Sprague Electric Co.
Walker Company.
Westinghouse El. & Mfg. Co.

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Sargent & Lundy.
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Wray Co., John C.

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Queen & Co.
Wagner Elec. Mfg. Co.
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Commercial El. Supply Co.
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Pacific Electric Co.
Palste Co., H. T.
Peru Elec. Mfg. Co.

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Electro-Plating Mach'y.
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Hobart Elec. Mfg. Co.
Noll & Co., C.

Enamel.
Smith, Mfg. & Enamel Co.

Engines, Gas.
Foos Gas Engine Co.
Otto Gas Engine Wks.
Wolverine Motor Works
Wray Co., John C.

Engines, Steam.
American Engine Co.
Ames Iron Works.
Armington & Sims Co.
Ball Engine Co.
Skinner Engine Co.
Westinghouse, Church, Kerr & Co.
Wray Co., John C.

Fan Outfits.
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Edison Mfg. Co.
Emerson El. Mfg. Co.
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Marietta Mfg. Co.
Schmidt Mfg. Co.
Specialty Mfg. Co.
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Western Electric Co.
Westinghouse El. & Mfg. Co.

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Fuse Wire.
American Elec. Fuse Co.
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Western Electric Co.

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General Electric Co.
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Hill, W. S. Electric Co.
Illinois Electric Co.
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Partrick, Carter & Wilkins.
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Holmes Fibre-Graphite Co.

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K. & W. Company.

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Illinois Electric Co.
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K. & W. Company.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Palste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Warner Elec. Mfg. Co.
Western Electric Co.

Insulated Wires and Cables—Magnet Wires.
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
Montauk Multiph. Cable Co.
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National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Reliable Elec. Supply Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Western Electric Co.

Junction Boxes.
Bossert Elec. Const. Co.
Leonard, H. Ward Elec. Co.

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Partrick, Carter & Wilkins.

Lamps, Incandescent.
Buckeye Electric Co.
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Electrical Exchange.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
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Lynn Incandescent Lp. Co.
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Sawyer-Man Elec. Co.
United Elec. Imp. Co.
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Westinghouse El. & Mfg. Co

Lightning Arresters.
Bissell & Co., F.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Magnet Wire.
(See Insulated Wires.)

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Besly & Co., Chas. H.
Link-Belt Machinery Co.
Pratt & Whitney Co.
Sibley & Co.
Stilwell-Bierce Smith-Valle
Westinghouse, Church, Kerr & Co.

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Commercial El. Supply Co.
Munsell & Co., Eugene.
Schoonmaker, A. G.

Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.

Motors.
Akron Elec. Mfg. Co.
American Engine Co.
Belknap Motor Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Northern Electl. Mfg. Co.
Sargent & Lundy.
Sprague Electric Co.
Stanley Electric Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

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Atlantic Alcatraz Asph. Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

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Baker & Co.

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Baily Mfg. Co.
Berthold & Jennings.
Central Mfg. Co.
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Torrey Canada Co.
Valentine-Clark Co.

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Swarts Metal Refining Co.

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Leonard, Ward, Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.

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Cincinnati Corrugating Co.

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Cormnan Co.
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Hine & Co., L. A.
Hodge, Walsh & Loring.

Shades.
Faries Mfg. Co.

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K. & W. Company.

Speaking Tubes.
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Electric Appliance Co.
Partrick, Carter & Wilkins.
Western Electric Co.

Speed Indicators.
Besly & Co., Chas. H.
Keystone El. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
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Electric Storage Battery Co.
High Tension El. Stor. Co.

Street Cleaning.
Stephenson Co., John.

Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred P.
New York Insulated Wire Co
Okonite Co., The.
Reliable Elec. Supply Co.
Simplex Electrical Co.
Standard Paint Co.
Washburn & Moen Mfg. Co.
Western Electric Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Bissell Co., F.
Cabinet Mfg. Co.
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Commercial El. Supply Co
Farr Tel. & Cons. Sup. Co.
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Kokomo Tel. & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co.
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N. W. Tel. Mfg. Co.
Dawson Electric Co.
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Stromberg-Carlson Tl. M. Co.
Viaduct Mfg.
Western Electric Co.
Western Tel. Cons. Co.

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Niles & Co., Mathias.

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Ft. Wayne Elec. Corporation.
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Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co

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Westinghouse El. & Mfg. Co.

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Am. Impulse Wheel Co.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Tatum Water Wheel Co.
Stilwell-Bierce Smith-Valle.

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Vulcanized Fibre Co.

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Brixey, W. R.
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Commercial El. Supply Co.
Electric Appliance Co.
Chicago Ins. Wire Co.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
Western Electric Co.

Woodwork, Electrical.
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Central Electric Co.
Commercial El. Supply Co
Queen & Co.

Additional Index of Advertisements See Page III.

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FOR ALL CIRCUITS, EXCEPT ALTERNATING.

OUR CEILING FANS AND ELECTROLIERS
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OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

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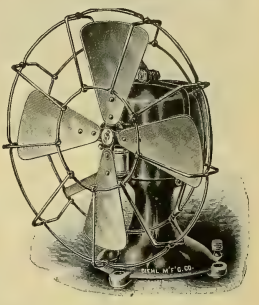

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ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

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DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

What Would You Say

to a Storage Battery giving any voltage and capacity in A SINGLE CELL? THE HIGH TENSION STORAGE BATTERY is such a Battery. . . . .

Furnished in all sizes, from Portables to Station Batteries of 5,000 ampere hour capacity and over.

2 volts per plate. Odorless. No slopping of acid. Self contained. No falling out of plugs. No short circuiting.

Correspondence solicited with reliable parties desiring to act as agents. For full particulars and catalogue address

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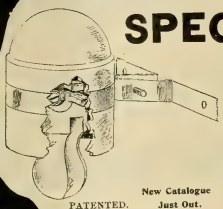
The High Tension Electric Storage Company,

HEED BUILDING, 1215 FILBERT STREET, PHILADELPHIA, PA.
Factory: Souderton, Pa.

PERU Watch This Space for SPECIALTIES.



ALL PORCELAIN TRANSFORMER FUSE PLUG.

PATENTED.

New Catalogue Just Out. Send for It.

(LONGEST FUSE ON MARKET—Best Results on 2,000 Volts.)

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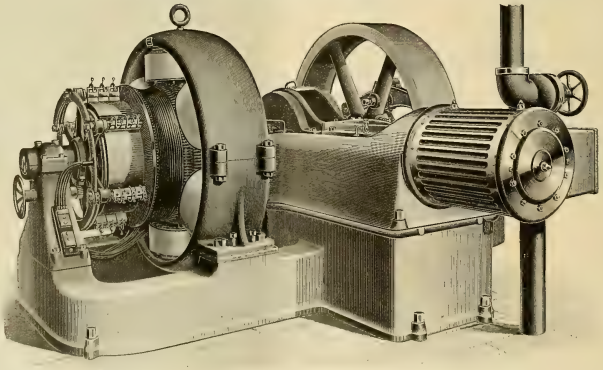
ELECTRICAL EXHIBITION

MADISON SQUARE GARDEN, NEW YORK.



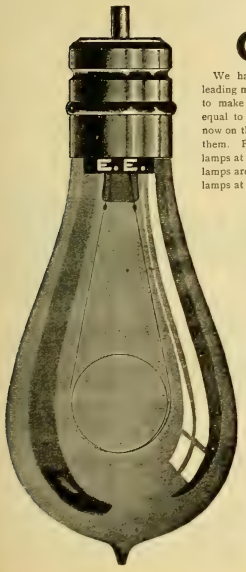
See our exhibit of a complete lighting and power plant, including an AMERICAN-BALL ENGINE AND DIRECT CONNECTED GENERATOR, furnishing current for illuminated signs, and driving one of our MULTIPOLAR MOTORS. The entire exhibit manufactured by us.

AMERICAN ENGINE COMPANY,

BOUND BROOK, N. J.

BUYERS will find no better or more honestly made goods than those of the K. & W. Company of Pittsfield, Mass. Their Hardy Incandescent Lamp is justly celebrated for its sustained candle power. Their Arc Hanger Board—an absolute cut out—is a model of workmanship and design. Their Dynamo Brush is a cool and quiet runner, and their Commutator Compound does prevent sparking. They have a New York Office at 120 Liberty Street, and their Western representatives are Meysenburg & Badt, 1504 Monadnock Block, Chicago. Their prices are moderate and parties wishing agencies will do well to communicate with them.

A Strictly High-Grade Lamp



15 CENTS.

We have just arranged with one of the leading manufacturers of incandescent lamps to make for us a strictly high-grade lamp, equal to any of the so-called "Trust" lamps now on the market, and superior to many of them. For the next 60 days we offer these lamps at 15 cents each, in barrel lots. These lamps are fully guaranteed. We sell refilled lamps at 13 cents each. Give us a trial order.

New Midget Upton 150-Hour Arc Lamp for 110-Volt Circuit, $15.00

A full line of Electrical Supplies carried in stock. Lowest possible prices.

2¼-inch Shade Holders, per doz., 25c.
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Send for copy of the *"Electrical Bulletin."*

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Over 1,000 machines for sale, of standard make: Incandescent Dynamos, Arc Dynamos, 110-220 and 500-Volt Motors, Motors for Alternating and Arc Circuits. Send for complete list. Arc Lamps, Transformers, Alternating and Direct-Current Meters. All standard makes in stock. Send for list giving net prices.

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Dealers in Everything Electrical,
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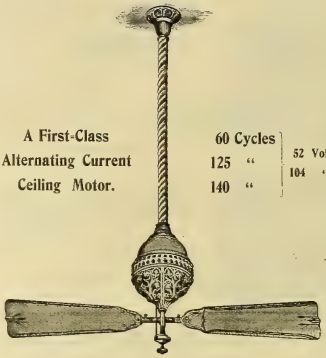
THE TUERK FAN

WESTERN ELECTRIC COMPANY,
GENERAL WESTERN

AGENTS.

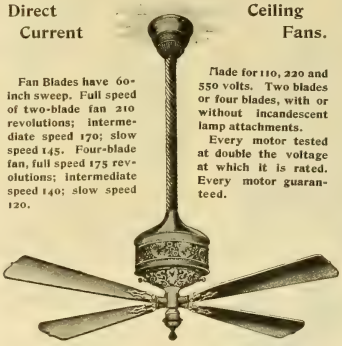


A First-Class Alternating Current Ceiling Motor.

60 Cycles — 52 Volts
125 " — 104 "
140 "

Manufacturers

Of Desk, Bracket, Column and Direct Current Ceiling Fans.



Fan Blades have 60-inch sweep. Full speed of two-blade fan 210 revolutions; intermediate speed 170; slow speed 145. Four-blade fan, full speed 175 revolutions; intermediate speed 140; slow speed 120.

Made for 110, 220 and 550 volts. Two blades or four blades, with or without incandescent lamp attachments.

Every motor tested at double the voltage at which it is rated. Every motor guaranteed.

Send for Catalog on Fans.

WESTERN ELECTRIC COMPANY,
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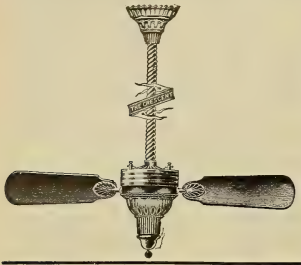

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Wound for Any Voltage.

DIRECT CURRENT.

WRITE FOR PARTICULARS.

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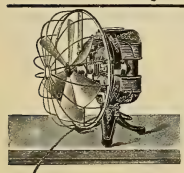
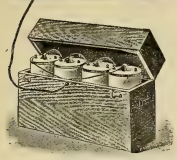
MARIETTA, PA.





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The most economical and efficient battery fan motor on the market.

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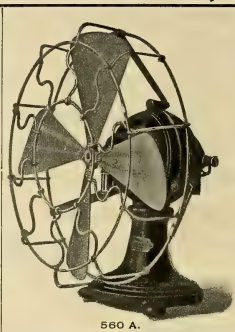

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'98 LUNDELL FANS.

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"	250 Volts	18.00
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Empire—Fan only 110 V.		22.00

5 PER CENT. DISCOUNT IN DOZEN LOTS.

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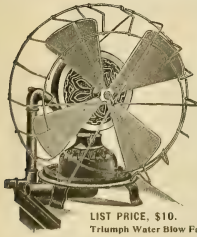

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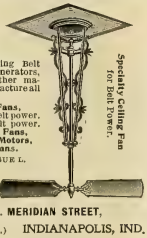
Triumph Water Fans,
Ceiling Fans for belt power.
Floor Fans for belt power.
Triumph Exhaust Fans,
Specialty Water Motors,
Electric Ceiling Fans.

SEND FOR CATALOGUE L.



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LIST PRICE, $10.
Triumph Water Blow Fan. (Pat. applied for.)

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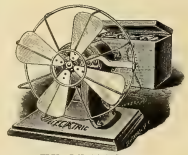

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6, 8 and 10 inch Fans with **"To the Moment"** improvements.

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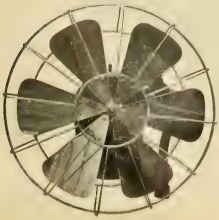

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As Easily Installed as an Electric Fan Motor.
Discounts for Exclusive Agents. Correspondence Solicited.

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List Price, $10.00.

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"I sold the ——— and the ——— fans last season, but I find that there are some Lundell fan motors in this city, and they take less current than the ones I sold last season, consequently they are cheaper to run. Upon what terms can I handle the Lundell?

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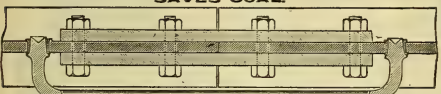

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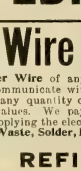

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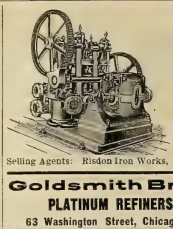

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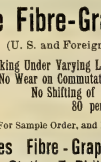

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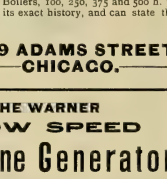

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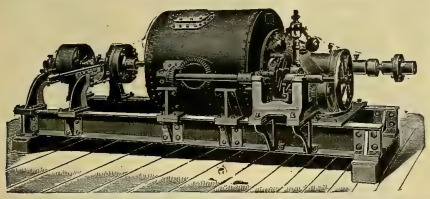

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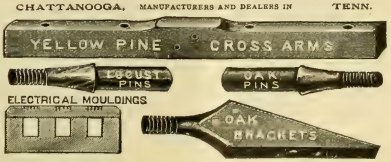

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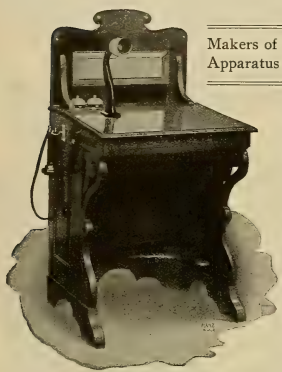

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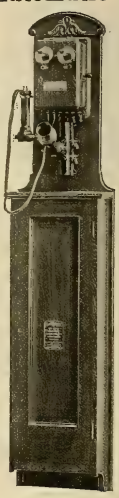

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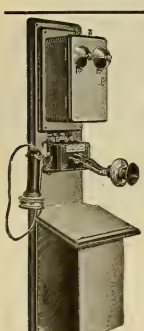

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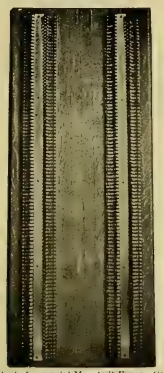

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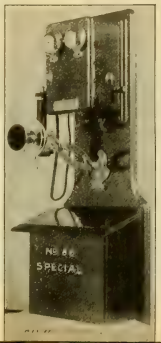

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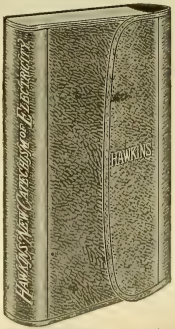

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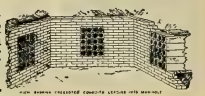

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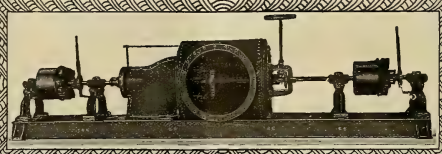

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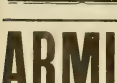

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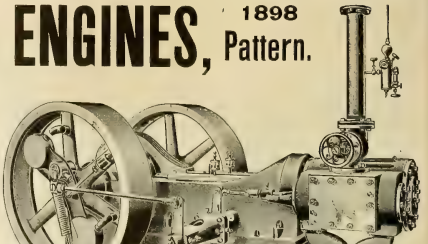

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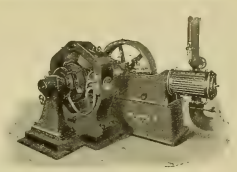

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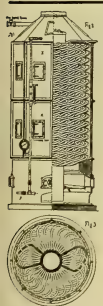

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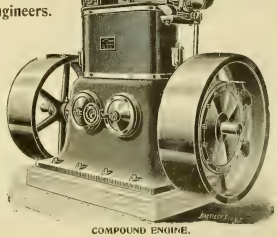

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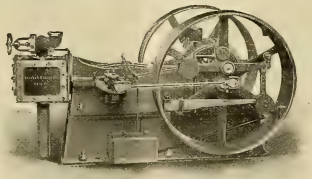

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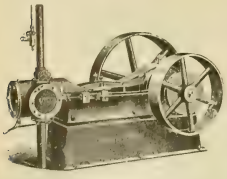

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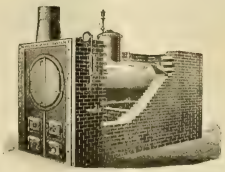

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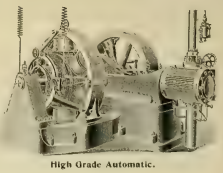

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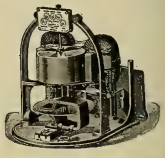

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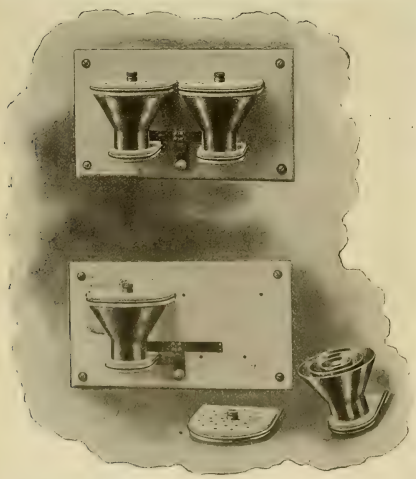

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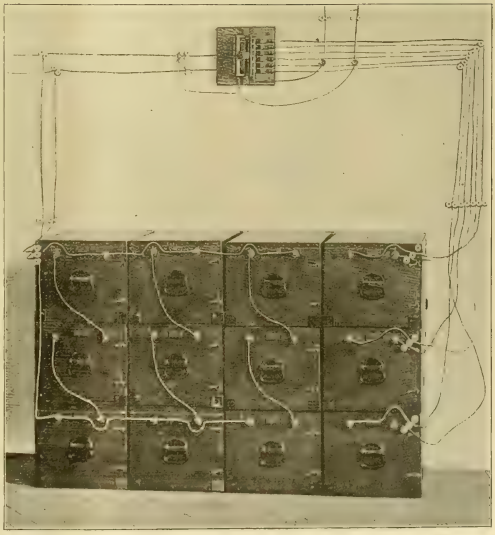

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Schneider Mfg. Co.
Specialty Mfg. Co
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Wagner Electric Mfg. Co.
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Western Electric Co.
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Diamond State Fibre Co.
Kartavert Mfg. Co.
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Queen & Co

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Okonite Co., The.
Paiste Co., H. T.
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Standard Underground C. Co.
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Western Electric Co.

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Chicago Ins. Wire Co.
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General Electric Co.
Illinois Electric Co.
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Illinois Electric Co.
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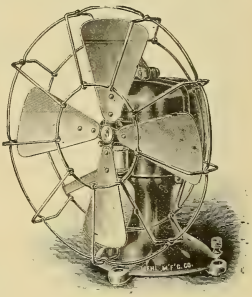

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Of Desk, Bracket, Column and

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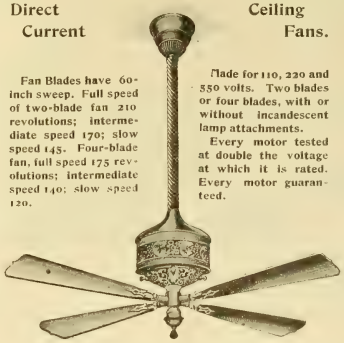
Fan Blades have 60-inch sweep. Full speed of two-blade fan 210 revolutions; intermediate speed 170; slow speed 145. Four-blade fan, full speed 175 revolutions; intermediate speed 140; slow speed 120.



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A PERTINENT POINT.

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"I sold the —— and the —— fans last season, but I find that there are some Lundell fan motors in this city, and they take less current than the ones I sold last season, consequently they are cheaper to run. Upon what terms can I handle the Lundell?

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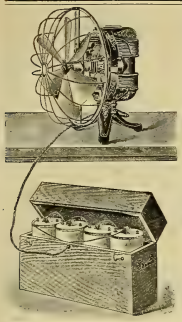

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The most economical and efficient battery fan motor on the market.

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Triumph Water Fans, Ceiling Fans for belt power. **Floor Fans** for belt power. **Triumph Exhaust Fans, Specialty Water Motors, Electric Ceiling Fans.**

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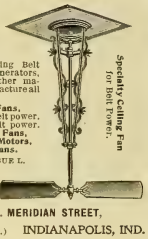

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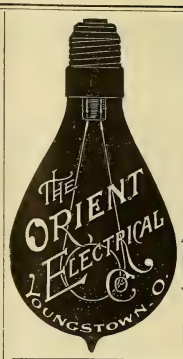

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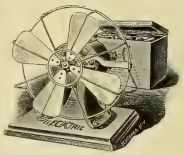

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Novel in Construction.
As Easily Installed as an Electric Fan Motor.
Discounts for Exclusive Agents.

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Simple, Economical, List Price, $10.00.

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Our Cellulose Filament is Unsurpassed by Any.

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Single Phase,
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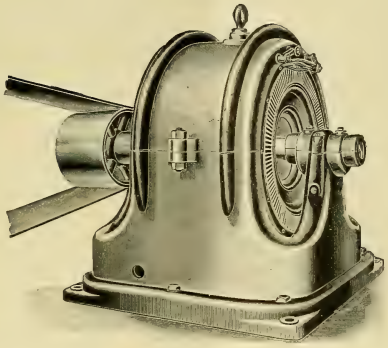

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The Greatest Commercial Efficiency.
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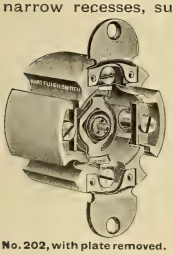

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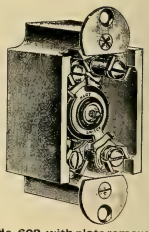
without disturbing your own frame or box. Simply take out the defective Switch and replace it with a HART.

For full particulars, see our Illustrated Catalogue, pages 14 and 28.

All Electrical Supply Houses carry these Switches in stock, and can fill orders without delay.



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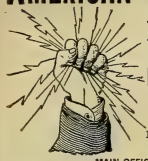

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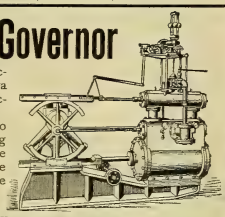

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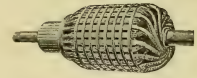

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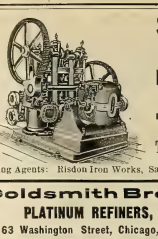
Proposals must be made out upon blank forms to be obtained at said office and be addressed to "West Chicago Park Commissioners," endorsed "Insulators," and must be accompanied with currency to the amount of five per cent. of the bid, or certified check for the same amount drawn on a responsible bank doing business in the city of Chicago, and made payable to the order of the West Chicago Park Commissioners.

The contractor to whom this work may be awarded will be required to furnish a bond in a sum equal to one-half the amount of contract, with sureties acceptable to said Park Commissioners.

The West Chicago Park Commissioners reserve the right to reject any or all bids.

JOSEPH W. SUDDARD, President.
Attest: ERNEST G. SCHUBERT, Secretary.



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The contractor to whom this work may be awarded will be required to furnish a bond in a sum equal to one-half the amount of contract, with sureties acceptable to said Park Commissioners.

The West Chicago Park Commissioners reserve the right to reject any or all bids.

JOSEPH W. SUDDARD, President.
Attest: ERNEST G. SCHUBERT, Secretary.

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ELECTRIC LIGHT SYSTEM.

Chicago, May 9th, 1898.

Sealed proposals will be received by the West Chicago Park Commissioners, at office in Union Park, until 4 o'clock p. m. of Tuesday, May 24th, 1898, to furnish 164 cut-out switches more or less, according to the specifications which are on file in the Engineer's office in Union Park.

Proposals must be made out upon blank forms to be obtained at said office and be addressed to "West Chicago Park Commissioners," endorsed "Switches," and must be accompanied with currency to the amount of five per cent. of the bid, or certified check for the same amount drawn on a responsible bank doing business in the city of Chicago, and made payable to the order of the West Chicago Park Commissioners.

The contractor to whom this work may be awarded will be required to furnish a bond in a sum equal to one-half the amount of contract, with sureties acceptable to said Park Commissioners.

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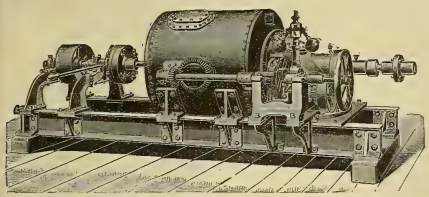

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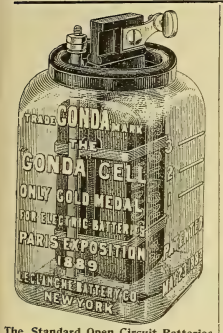

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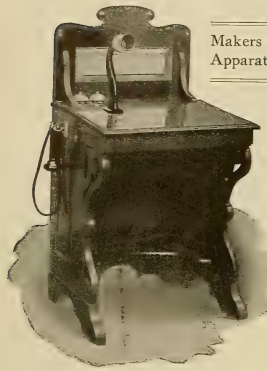

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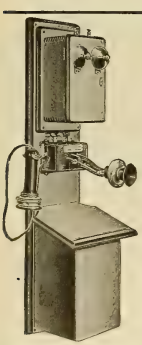

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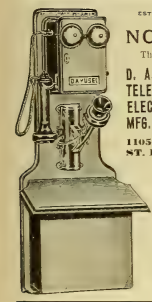

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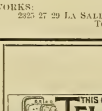

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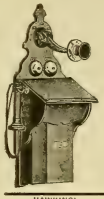

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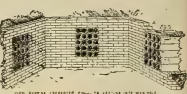

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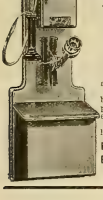

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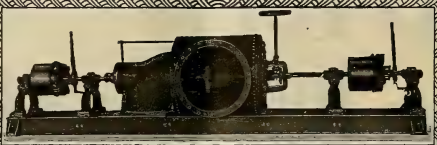

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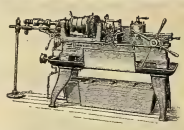

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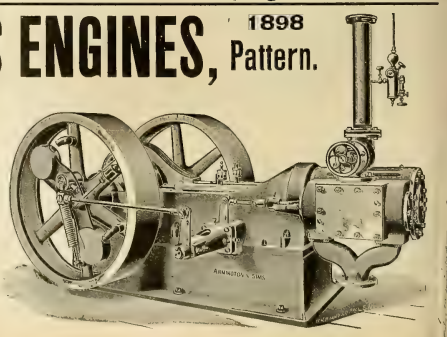

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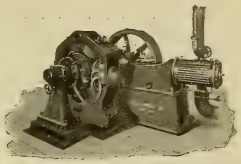

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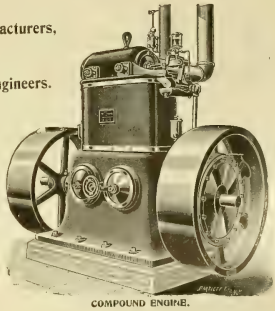

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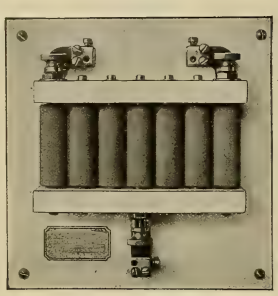

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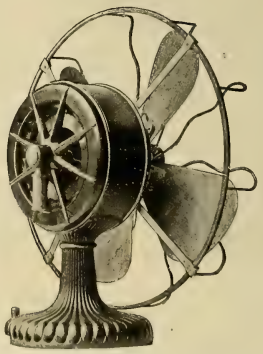

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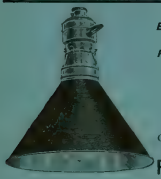

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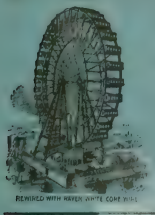

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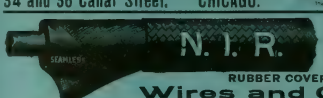

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National India Rubber Co's RUBBER COVERED Wires and Cables.

OFFICE and FACTORY: BRISTOL, R. I.

ARMATURES REWOUND

Of all kinds, and General Repair Work at lowest rate for high-class work.

ALL WORK GUARANTEED. Estimates promptly furnished.

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Engineers and Contractors. W. C. BALDA, Mgr. UTICA, N. Y.

THE AKRON ELECTRICAL MFG. CO.,

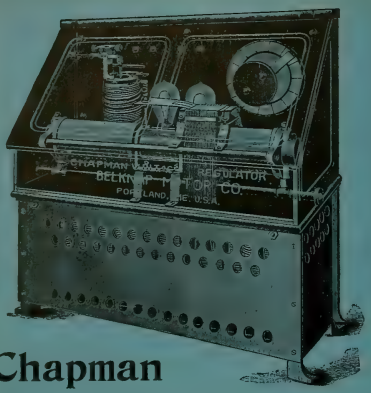
AKRON, OHIO.

MAKES

Generators, Motors, Direct-Connected, Slow Speed, Moderate Speed, Mining Locomotives.

All of the highest efficiency, most modern construction and most graceful design.

WRITE FOR CIRCULARS AND READ OUR GUARANTEE.



Chapman Voltage Regulators

insure **Steady Light** from unsteady power.
For use with Steam or Water Plants.
—**No Attendance Required.**—
Regulator sent on 30 days' trial.
Let us show what it can do for you.

Belknap Motor Company,
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New York Office, 27 Thames Street. Boston Office, 620 Atlantic Ave.

INCANDESCENT LAMPS 12 cents.

Now is the time to get your burned out lamps together and have them renewed or turned into cash. We have now repaired over 700,000 lamps, and nine out of ten of our shipments are to old customers.

We use the same care as regards voltage, candle power, etc., as in making our new lamps.

We are now pleasing central station managers by supplying a uniform and efficient lamp at a price that makes it profitable to replace lamps every 600 hours or oftener.

The renewal of lamps makes this possible.

If you prefer new lamps, we can supply you with the best and allow you three cents each for your burned out lamps.

Lynn Incandescent Lamp Co.,

LYNN, MASS.

The Phoenix Glass Co.

OF PITTSBURG, PA.,

HAS REMOVED
its New York Office to
15 Murray Street

FRANKLIN BUILDING,

where all the extensive and various lines of **The Phoenix Glass Company's** well-known manufacture are on exhibition, consisting of **Arc and Incandescent Electric Globes and Shades,** Gas and Kerosene **Globes and Shades, Decorated Vase Lamps, &c.**

ORIGINAL.
the PIONEER.
STANDARD.

...Sawyer-Man Incandescent Lamps...

IT NEVER DISAPPOINTS

A full assortment carried in Chicago stock.....

Central Electric Company,

GEO. A. McKINLOCK, President.
CHARLES E. BROWN, Secretary.
S. R. FRAZIER, Treasurer.

264, 266, 268, 270 FIFTH AVENUE,
CHICAGO.

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WE MAKE CUTS OF ALL KINDS
READERS OF THIS JOURNAL, IN NEED OF CUTS, WILL DO WELL TO GET OUR PRICES BEFORE ORDERING ELSEWHERE.
20 YEARS IN THE BUSINESS.
CHICAGO ELECTRO & STEREOTYPE CO.
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The new installment plan of The International Correspondence Schools, Scranton, Pa.—the largest and most successful institution teaching technical subjects by mail—places an education within the reach of all. Students may enroll upon paying $2 in advance, the balance to be paid at the rate of $2 a month. The charges are moderate and include all necessary text-books. Studies are carried on at home without loss of time from work.

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The Mechanical-Electrical Scholarship includes instruction in mechanical and electrical engineering and is intended especially for those who wish to become designers of electrical machinery.

Also 11 courses including Steam Engineering, Mechanical Drawing, Machine Design, Civil Engineering, Bookkeeping, Shorthand and English branches.

Write for circular, stating subject in which you are interested.

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F. HARDTMUTH & CO., VIENNA, AUSTRIA.

We having received a very large shipment of

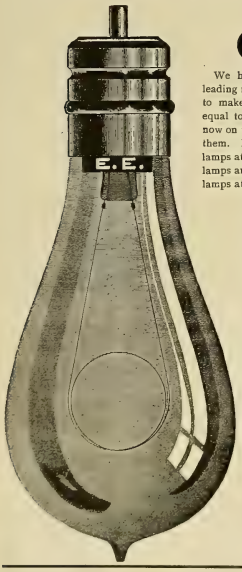
CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

Chicago Edison Company,

General Western Agents, 139 Adams Street, Chicago.

A Strictly High-Grade Lamp 15 CENTS.



We have just arranged with one of the leading manufacturers of incandescent lamps to make for us a strictly high-grade lamp, equal to any of the so-called "Trust" lamps now on the market, and superior to many of them. For the next 60 days we offer these lamps at 15 cents each, in barrel lots. These lamps are fully guaranteed. We sell refilled lamps at 13 cents each. Give us a trial order.

New Midget Upton 150-Hour Arc Lamp for 110-Volt Circuit, $15.00

A full line of Electrical Supplies carried in stock. Lowest possible prices.

2½-Inch Shade Holders, per doz., 25c.
Edison Wiring Receptacles, each, 4c.
Climbers, per pair, - - - 75c.
3-Inch Iron Box Bells, each, - 20c.

Send for copy of the "*Electrical Bulletin*."

Electrical Machinery.

Over 1,000 machines for sale, of standard make: Incandescent Dynamos, Arc Dynamos, 110-220 and 500-Volt Motors, Motors for Alternating and Arc Circuits. Send for complete list. Arc Lamps, Transformers, Alternating and Direct-Current Meters. All standard makes in stock. Send for list giving net prices.

The Electrical Exchange,

Dealers in Everything Electrical,

166-174 S. Clinton St., CHICAGO.

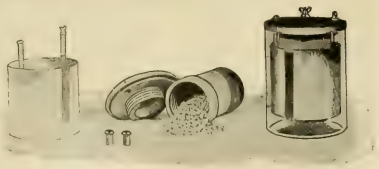
No charge for boxing and carriage if "Western Electrician" is mentioned.

The American Electric Meter Co.,

9th St. and Montgomery Ave., Philadelphia, Pa.,

Is now prepared to take orders for early delivery of all sizes of 3-Wire Constant Potential Registering Meters.

This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
This meter is hermetically sealed.
This meter measures correctly with uneven loads.
This meter can be calibrated with a watch in six minutes.
This meter requires no lubrication.
This meter is magnetically shielded.
This meter is direct reading, having no multiplier.
This meter does not require one-thousandth of a horse power.
This meter will operate for years without opening.
This meter has no springs, jewels or frictional errors.
This meter once right is always right.



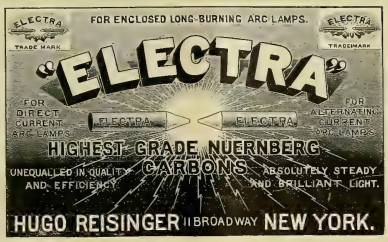
For long distance and hard worked phones, use the National No. 3 Carbon Porous Cup Cell; the largest open circuit cell in the field. Elements adapted to a standard 6 in. x 8 in. jar.

THE NATIONAL CARBON CO.

600 HIGHLAND AVENUE, - - - CLEVELAND, OHIO.

All genuine "ELECTRA" Carbons are put up in packages bearing a label with the TRADE MARK "ELECTRA."

Infringers of my trade-mark will be rigidly prosecuted to protect the interest of purchasers of my carbons.



Notice—The "ELECTRA" Highest Grade Nuernberg Carbons are, as heretofore, manufactured for me by the world-renowned firm of **C. Conradty, of Nuernberg,** who owns both the oldest as well as the **largest carbon works in existence,** and whose carbons are recognized as the standard all the world over.

Interior Thermostatic Electric Cables.

STANDARDIZED IN ALL B. & S. GAUGES.

We own the following Letters Patent issued by the United States, which broadly cover the construction and basic principle of our cables, viz.:

No. 546,261
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No. 565,053
No. 565,178
No. 565,188
No. 565,217
No. 565,410
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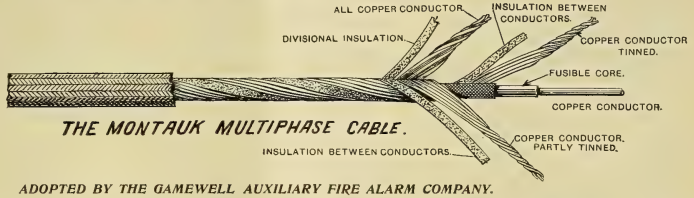
No. 594,281



THE MONTAUK MULTIPHASE CABLE.

ADOPTED BY THE GAMEWELL AUXILIARY FIRE ALARM COMPANY.

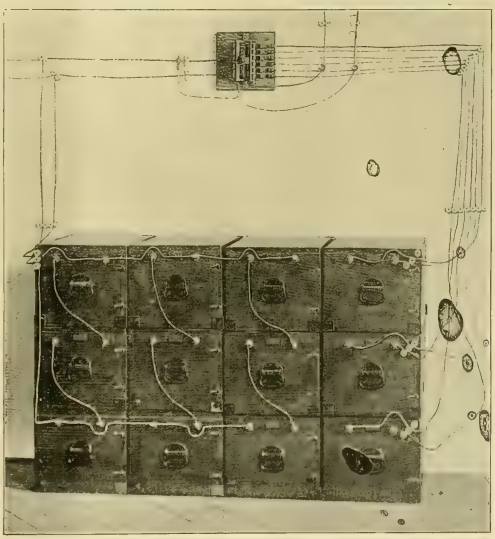
Write for Descriptive Matter.
Call and See Cables Demonstrated.

MONTAUK MULTIPHASE CABLE CO.,

100 BROADWAY, TELEPHONE, 4031 CORTLANDT. NEW YORK.

What Would You Say

to a Storage Battery giving any voltage and capacity in a SINGLE CELL? THE HIGH TENSION STORAGE BATTERY is such a Battery. . . .



Furnished in all sizes, from Portables to Station Batteries of 5,000 ampere hour capacity and over.

2 volts per plate. Odorless. No slopping of acid. Self contained. No falling out of plugs. No short circuiting.

Correspondence solicited with reliable parties desiring to act as agents. For full particulars and catalogue address

The High Tension Electric Storage Company,

HEED BUILDING, 1215 FILBERT STREET, PHILADELPHIA, PA. Factory: Souderton, Pa.

The Zamel Arc Light Meter

AND ELECTRIC CURRENT TIMER

Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights,

It Is Positive in Its Action.

SEND FOR CIRCULAR.

Zamel Arc Light Meter Co.,

266 BLUE ISLAND AVE., CHICAGO, ILL.

Approved by the National Fire Underwriters' Association.

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Berlin Iron Bridge Co.

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Central Electric Co.
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Electric Appliance Co.
Huebel & Manger
Partrick, Carter & Wilkins.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
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Eastern Electric Cable Co.
General Electric Co.
Illinois Electric Co.
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New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.

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Electric Appliance Co.
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Schiff, Jordan & Co.

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Dearborn Drug & Chem. Wks
Electric Appliance Co.
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Int. Correspond. Schools.

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Central Electric Co.
Commercial El. Supply Co.

Cross-Arms, Pins and Brackets.
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Brady, T. H.
Central Electric Co.
Central Mfg. Co.
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Electric Appliance Co.
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Farr Tel. & Cons. Sup. Co.
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Commercial El. Supply Co.
Cutter El. & Mfg. Co.
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Emerson El. Mfg. Co.
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Paiste Co., H. T.
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Peru Elec. Mfg. Co.
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Bullock Elec. Mfg. Co.
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Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
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General Electric Co.
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Broomell, Schmidt & Co.
Fuel Economizer Co

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American El. Meter Co.
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General Electric Co.
Sprague Electric Co.
Walker Company.
Westinghouse El. & Mfg. Co.

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Broughton, H. P.
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Queen & Co.
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Ames Iron Works.
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Munsell & Co., Eugene.
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New York Insulated Wire Co.
Okonite Co., The.
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Standard Underground C. Co.
Vulcanized Fibre Co.
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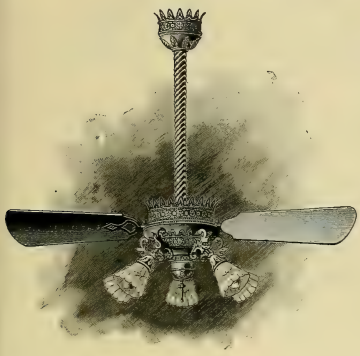

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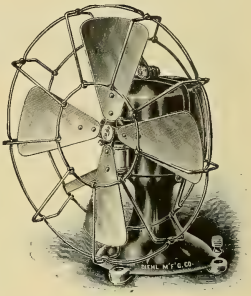

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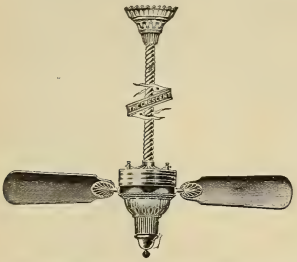

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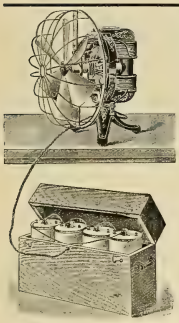

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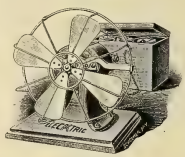

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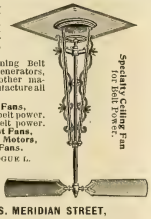

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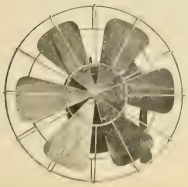

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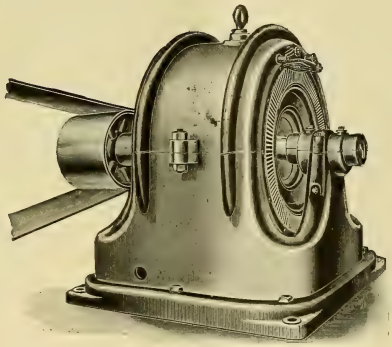

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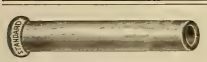

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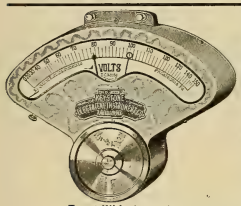

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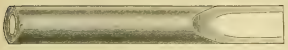

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NOTICE.

Plans and specifications adopted by the mayor and common council of the city of Fond du Lac, Wisconsin, relative to granting a telephone franchise on certain streets in said city.

RESOLVED, By the Mayor and Common Council of the city of Fond du Lac, Wisconsin, That whereas, an application for a franchise has been made for a telephone line along and upon Scott street west to Doty street, south on Doty street to Division street, thence east on Division street to Macy street, thence south on Doty street to Division street, thence east on Division street to Macy street, thence south on Macy street to Forest avenue, thence east on Forest avenue to the alley between Macy and Main streets, thence south on said alley to Remington Company's drug store in said city; and whereas, the franchises in said city must be by law sold and granted to the highest bidder therefor,

Therefore notice is hereby given to all whom it may concern or who may wish to bid for said franchise for said telephone line in said city, that bids therefor will be received sealed by the said common council of said city up to 8 o'clock p. m. of Monday, June 6th, 1898, addressed to City Clerk, F. A. Bartlett, Esq., Fond du Lac, Wisconsin.

And that the said franchise will on said date be granted to the highest and best bidder therefor, according to the plans and specifications now on file in the said city clerk's office.

That not more than $1.50 a month shall be charged to private houses, nor more than $2.50 to business houses per month, under said franchise, that the manager and treasurer of said company operating said franchise must once each year make and file with said common council a verified statement of the gross receipts for such business carried on under said franchise; and said bids must state what percentage the bidder will pay on the gross receipts a year under said franchise, if granted to him, into the treasury of said city for the use of said city; said telephone line or lines on said streets to be erected on poles firmly set in the ground where the street committee of said common council shall direct, and the poles not to be over two hundred and fifty feet apart, and the wires on said poles to be at least where fastened on said poles 30 feet above the earth just beneath, with two pins on said posts for the use of said city for wires, for fire alarm purposes only, and that these are the plans and specifications adopted by said mayor and common council for the maintenance and operation of said franchise, and that a certified check of the sum and amount of $200.00 shall accompany all bids as a guarantee of the acceptance of said franchise if granted to the bidder; and shall give bonds to the city in the sum of $300.00 by said bidder conditioned on the building, construction and operation of said plant and franchise within two months after its award and grant by the said common council to the bidder therefor, and that work under said franchise shall commence and continue in good faith under said franchise within one year after it is granted; and if not, then said franchise shall be null and void and of no effect.

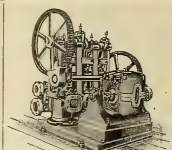
And that these resolutions and specifications inviting bids for said franchise be published for three weeks, once each week, in the Fond du Lac Daily Commonwealth, in the Milwaukee Sentinel, and in the Telephone of Chicago, Illinois, to comply with chapter 370 of the laws of Wisconsin for the year 1897.

By order of the common council of Fond du Lac city, Wisconsin.

Dated May 2, A. D., 1898.

T. F. MAYHAM,
Mayor of the City of Fond du Lac, Wisconsin.

Attest: F. A. BARTLETT,
Clerk of the City of Fond du Lac, Wisconsin.



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PROPOSALS.

Proposals will be received by the Board of Trustees of the Village of Western Springs, Ill., until 8 o'clock p. m. of Tuesday, May 24, 1898, for furnishing materials and labor for a complete street lighting plant according to the plans and specifications which may be seen in the office of W. H. Schott, 5504 South Halsted St., Chicago.

Parties submitting bids will be required to deposit with bid a certified check of 5 per cent. of the amount of their bid, payable to the treasurer of the village.

In case the successful bidder fails to enter into contract within five days after he has been notified of its acceptance he shall forfeit the check deposited. The successful bidder will be required to furnish an approved bond in such sum as may be decided by the trustees of Western Springs, said bond to indemnify the Village of Western Springs against accident during construction of plant, and the full compliance and completion of plant within 60 days from date of signing contract.

The village reserves the right to reject any or all bids. All bids must be addressed to C. Herman Jackson, clerk of said village. Plans may be seen and copies of specifications obtained by inquiring of W. H. Schott, 5504 South Halsted Street Chicago.

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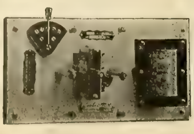

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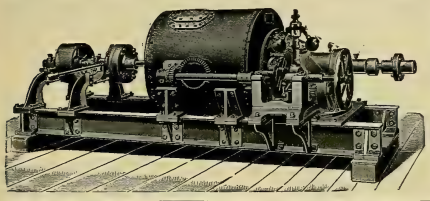

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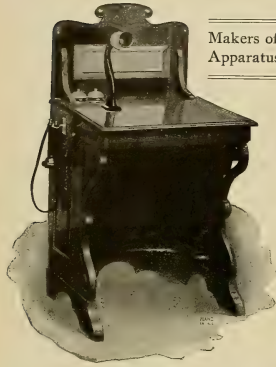

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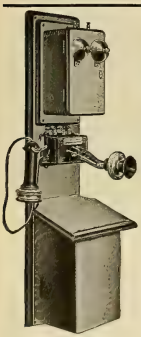

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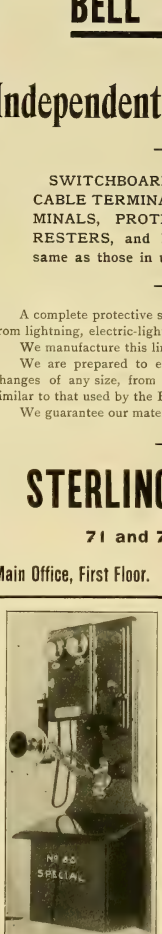

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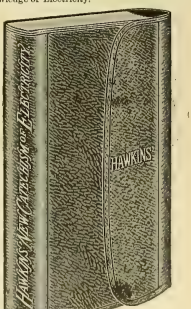

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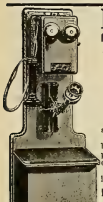

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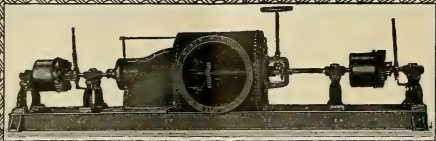

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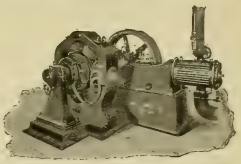

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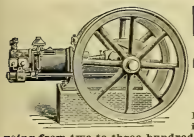

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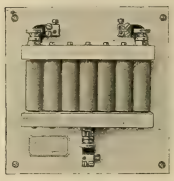

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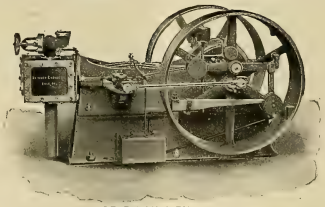

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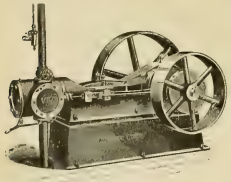

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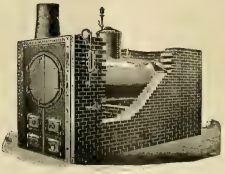

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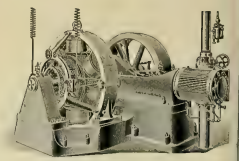

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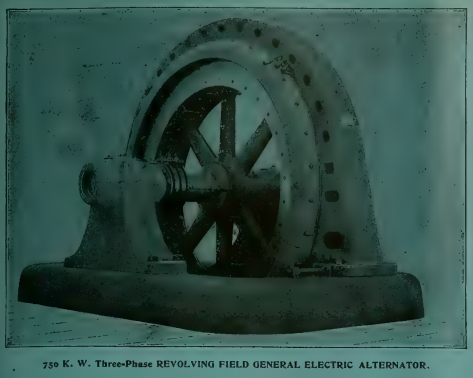

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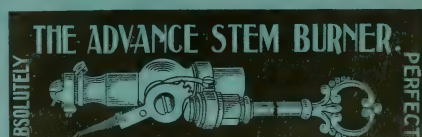

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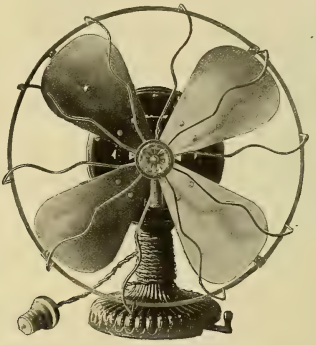

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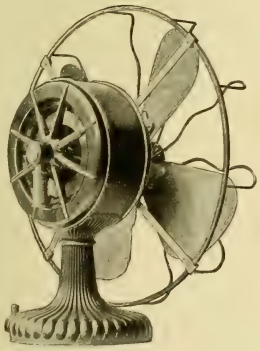

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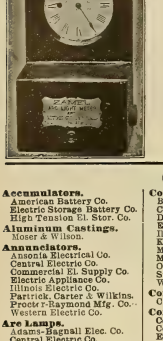

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Cherry Electric Works.
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Illinois Electric Co.
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Queen & Co.
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Western Electric Co.
Weston Electrical Inst. Co.

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Illinois Electric Co.
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Pacific Electric Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.

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Varley Electro Magnet Co.

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Besly & Co., Chas. H.
General Electric Co.
Hobart Elec. Mfg. Co.
Nott & Co., A. D.

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Otto Gas Engine Wks.

Engines, Steam.
Ames Iron Works.
Armington & Sims Co.
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Skinner Engine Co.
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Illinois Electric Co.
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Schneider Mfg. Co.
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Wagner Electric Mfg. Co.
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Karavaert Mfg. Co.
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Hill, W. S. Electric Co.
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Commercial El. Supply Co.
Phoenix Glass Co.

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Lombard Water Wheel Gv. Co.

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Holmes Fibre-Graphite Co.

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K. & W. Company.

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Brixey, W. R.
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Chicago Edison Co.
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Goodyear Vulcanite Co.
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Illinois Electric Co.
Karavaert Mfg. Co.
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National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
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Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wagner Elec. Mfg. Co.
Western Electric Co.

Insulated Wires and Cables—Magnet Wires.
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Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
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Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
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Moore, Alfred P.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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Standard Underground C. Co.
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Paries Mfg. Co.

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United Elec. Imp. Co.
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Warren Elec. Mfg. Co.
Warren-Medbery Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wray Co., John C.

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Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

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Cornman Co.
Electrical Exchange.
Hine & Co., L. A.
Hodge, Walsh & Loring.

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Paries Mfg. Co.

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Queen & Co.
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Electric Storage Battery Co.
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Kusel, D. A. Tel. & El Mfg. Co.
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Manus Electric Co.
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Stromberg-Carlson Tel. M. Co.
Vladmir Co.
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Western Electric Co.
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Samson Cordage Wks.

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Brill, The J. G. Co.
Westinghouse El. & Mfg. Co.

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Leffel & Co., Jas.
Pelton Water Wheel Co.
Stilwell-Bierce Smith-Valle.

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Rose Polytechnic Inst.
Worcester Polytechnic Inst.

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Brixey, W. R.
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Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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OUR CEILING FANS AND ELECTROLIERS
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Our Desk and Bracket Fans are Built of the Finest Material and are the

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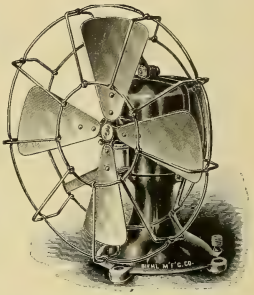
Of Any on the Market.



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The S-W Arc Light Radiators.

BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.

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SHADOWLESS RADIATOR MFG. CO.,
FARIBAULT, MINN.

THE AKRON ELECTRICAL MFG. CO.,
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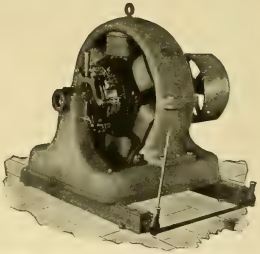
MANUFACTURE

ELECTRIC MINING,
LIGHTING AND POWER
MACHINERY,
ALL OF
THE HIGHEST GRADE.



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The Best System of Belting in the World

Compared with Straight Belts - - { Easier on bearings, Smaller per cent. of slip, One-half the space.

Compared with Clutches - - - - { Less expense, More efficient in operation, Great saving in space.

Compared with Direct Coupling - { About the same floor space, Cost much smaller, Easier to keep in repair.

Write for Further Particulars.

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12-inch Desk ...Fan Motors

Are now made for all voltages
up to and including.....

230 VOLTS.

This to meet the demand.

SPRAGUE ELECTRIC COMPANY,

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SAWYER-MAN LAMPS

Still lead all others

in efficiency, maintenance of candle power and careful attention to details of construction.

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For sale by leading supply houses.

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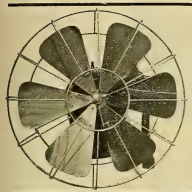

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Novel in Construction.
As Easily Installed as an Electric Fan Motor.
Discounts for Exclusive Agents.

Simple, Economical, **Effective, Noiseless.**
Correspondence Solicited. List Price, $10.00.

JUST THE THING FOR SUPPLY HOUSES TO CARRY.
Agents Wanted.

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Apparatus for

Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.

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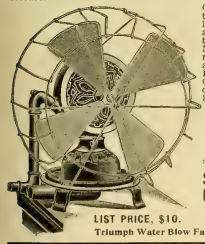
State Water Pressure. **THE ELECTRICIAN'S BEST FRIEND.**



Our Fans and Motors are in your line. You sell them and get a new customer. Our Water Motors are the most powerful and are used for running Belt Fans, Telephone Generators, Coffee Mills and other machinery. We manufacture all kinds of fans.

Triumph Water Fans, Ceiling Fans for belt power.
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Triumph Exhaust Fans, Specialty Water Motors, Electric Ceiling Fans.

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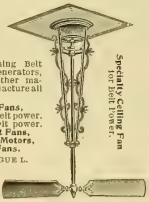

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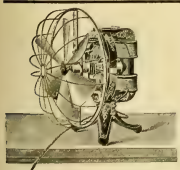
361 TO 367 S. MERIDIAN STREET,

LIST PRICE, $10.

Triumph Water Blow Fan. (Pat. applied for.) INDIANAPOLIS, IND.



Edison 9-inch Battery Fan Outfit.....

MOTOR WITH BALL BEARINGS.

The most economical and efficient battery fan motor on the market.

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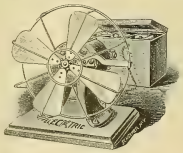


reaches from the Atlantic to the Pacific and protects the people at desk, home and sick room.

If you have seen our flyers you will send an order. If you have "missed them," write for circular.

KNAPP MOTORS. GORDON CELLS.

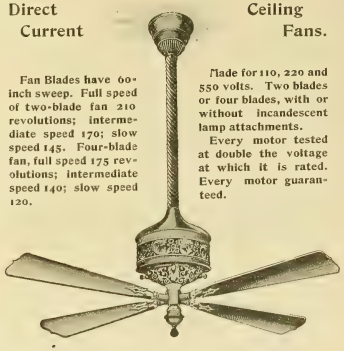
GORDON-BURNHAM BATTERY CO.,

Dept. 3. 594 BROADWAY, NEW YORK.

Manufacturers

Of Desk, Bracket, Column and

Direct Current Ceiling Fans.



Fan Blades have 60-inch sweep. Full speed of two-blade fan 210 revolutions; intermediate speed 170; slow speed 145. Four-blade fan, full speed 175 revolutions; intermediate speed 140; slow speed 120.

Made for 110, 220 and 550 volts. Two blades or four blades, with or without incandescent lamp attachments.

Every motor tested at double the voltage at which it is rated. Every motor guaranteed.

Send for Catalog on Fans.

WESTERN ELECTRIC COMPANY,

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WE WILL PAY 12c. PER LB. FOR SCRAP COPPER

WE WILL PAY 2 CENTS

Each at our factory for **100,000** burned out lamps. A special price for series lamps on bases.

If, instead of selling them to us, you want them renewed and returned, it will cost 12 cents each.

They will go back BETTER lamps than you had in the first place; we clean the bulbs until they are as clear as crystal; we use the finest cellulose filaments, that in purity, density and surface are UNSURPASSED by any.

You will be perfectly satisfied with the results.

We will supply Central Stations and other large consumers with the best quality of Renewed Lamps at 13 cents in barrel lots. Send in your old lamps.

We also manufacture a Superior Quality of Copper Dynamo Brushes and Commutator Springs.

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AND
D & W FUSES

THIS COMBINATION CANNOT BE BEAT.

D & W are **NON-ARCING** Fuses.

D & W are **SAFE** Fuses.

D & W Fuses are Accurate in Current Value.

D & W Fuses are Accurate in Time Value.

D & W Fuses can be held in the hand with safety while the primary mains of a 400 K. W., 2000 Volt Generator are Short-Circuited through the Device.

D & W Fuses will Dissipate 100 K. Ws. of Electric Energy without Flash, Smoke or Noise.

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AND

MOTOR VEHICLES.

With the advent of the Willard Battery the Motor Vehicle was made an assured success, and although the motor vehicle type of Willard Battery has been on the market but a year, yet its superiority is so manifest that it has been adopted by 90 per cent. of the manufacturers of electric motor vehicles, with every probability that the remaining 10 per cent. will adopt it when they have concluded their tests now in progress.

The motor vehicle type of Willard plate embodies all of the many superior qualities of the Willard Standard plate in points of electrical and mechanical construction—the rolled lead, the thin leaf, the angle of the leaf, the cup-shape groove, the immense surface, the perfect contact, the direct electrical path, the rapid action, the great conductivity, the uniformity of and provision for expansion, etc., etc., which features overcome all of the numerous faults developed by storage batteries in the past. To illustrate fully the many advantages of this construction would require many pages. But as an example of a single feature, we call your attention to the position of the thin leaves at an angle. This provision for the expansion of the active material as the years run along and the active material increases and expands the angle of the leaves is reduced, thus increasing the space between them and providing more room for the active material without loss of active material or any ill effect whatever. We claim the advantages of this feature are enormous. Many others have tried to restrain the acts of Nature. We have provided for them and consequently are free from all the bending, buckling, breaking and bridging that follow the other construction. The only differences between the Standard and the motor vehicle plates are that the motor vehicle plate is made of lighter weight rolled lead, the leaves are thinner, and they cross the plate at an angle and in relation to one another at opposite angles, one either side of the plate, and there is a greater amount of active material in the motor vehicle plate.

The positive plates of the motor vehicle type are surrounded by cellulose pulp and enclosed in patented hard rubber corrugated and perforated sheaths, which sheaths are firmly held between grooves in an improved hard rubber containing cell. The cover of the cell is so constructed that it may be removed at will. Likewise the positive plates may be removed at will, without interference with the negative plates and in a moment's time. The chief advantages of the Willard Motor Vehicle cell over the Standard cell are in weight and capacity. Thus a cell weighing 20 pounds will give 58 amperes in one hour, 81 in three hours, or 94 in five hours. Like all of the Willard Batteries the motor vehicle type will receive or give forth an enormous current. As an example, it may be charged in twenty minutes sufficiently to operate a carriage for ten miles. An examination of a Willard Motor Vehicle cell will show that no expense is spared to make it perfect in all ways. No attempt is made to create out of it a cheap article, and while a trifle more expensive than other batteries for this purpose, yet it is infinitely superior in actual results, and as a result a manufacturer of electrical motor vehicles can offer no greater inducement than the fact that his carriage is equipped with Willard Batteries. It is proof positive that at least in the essential feature his carriage or wagon is of the highest quality.

Beyond the motor vehicle type of battery we make a Standard type suitable for all applications of storage battery from small work to the largest central station or street railroad work, and a concentric type especially adapted to light work, such as telegraph, telephone, fire-alarm, etc., etc., and we respectfully solicit correspondence from parties interested in electric storage batteries for whatever kind of work.

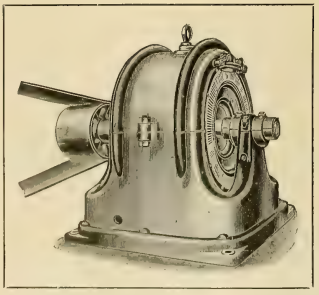
MANUFACTURED BY

SIPE & SIGLER, Cleveland, Ohio.

THE WARREN-MEDBERY Co

Sandy Hill, N. Y., U. S. A.,

SOLE MANUFACTURERS OF THE



Improved Inductor Alternator.

Single-Phase, Polyphase, 133 or 60 Cycles. Complete Station Equipment. Belted and Direct-Connected. Machines made for any voltage up to 10,000 volts.

The Greatest Commercial Efficiency.
The Best Inherent Regulation.
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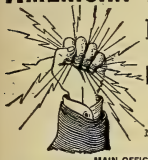
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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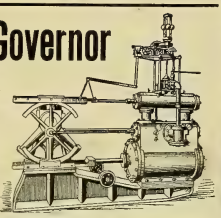

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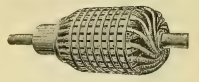

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A general manager to take full charge of fully equipped plant in the manufacture of dynamos, motors, etc. One who is a good salesman and understands his business and will take monied interest only need apply. Address "T." (2d floor), 643-647 Kent Ave., Brooklyn.

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Position by young man of twenty-two years of age; position as superintendent of a telephone system. Has been in contracting business for himself for three years and thoroughly understands constructing of telephone lines and making of instruments and has thorough business qualities. Good references. Address **E. C. Masters,** Everett, Pa.

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Best prices paid for scrap copper wire and commutator segments. Red brass wanted.

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Winders direct from T.-H. and Westinghouse shops. Work guaranteed. Ten years' experience. Light plants installed complete. Send for prices.

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Storage battery, 55 cells, 150 ampere-hours each; good condition and practically new, and 6 h. p. motor, 110 volts, and appurtenances for an electric launch equipment. **SINTZ GAS ENGINE CO.,** Grand Rapids, Mich.

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Electric lighting plant, in town of 1,500, within 40 miles of Chicago. 600 light alternator, profitable street lighting contract and commercial lighting; capacity of plant can be doubled; no competition. Will sell on easy terms, or exchange for second-hand electrical apparatus of standard make. **The Electrical Exchange,** 166-174 N. Clinton St., Chicago.

NOTICE.

Plans and specifications adopted by the mayor and common council of the city of Fond du Lac, Wisconsin, relative to granting a telephone franchise on certain streets in said city.

RESOLVED, By the Mayor and Common Council of the city of Fond du Lac, Wisconsin, That whereas, an application for a franchise has been made for a telephone line along and upon Scott street west to Doty street, south on Doty street to Division street, thence east on Division street to Macy street, thence south on Doty street to Division street, thence east on Division street to Macy street, thence south on Macy street to Forest avenue, thence east on Forest avenue to the alley between Macy and Main streets, thence south on said alley to Remington Company's drug store in said city; and whereas, the franchises in said city must be by law sold and granted to the highest bidder therefor,

Therefore notice is hereby given to all whom it may concern or who may wish to bid for said franchise for said telephone line in said city, that bids therefor will be received sealed by the said common council of said city up to 9 o'clock p. m. of Monday, June 6 h, 1898, addressed to City Clerk, F. A. Bartlett, Esq., Fond du Lac, Wisconsin.

And that the said franchise will on said date be granted to the highest and best bidder therefor, according to the plans and specifications now on file in the said city clerk's office.

That not more than $1.50 a month shall be charged to private houses, nor more than $2.50 to business houses per month, under said franchise, that the manager and treasurer of said company operating said franchise must once each year make and file with said common council a verified statement of the gross receipts for such business carried on under said franchise; and said bids must state what percentage the bidder will pay on the gross receipts a year under said franchise, if granted to him. Into the treasury of said city for the use of said city; said telephone line or lines on said streets to be erected on poles firmly set in the ground. The chairman of committee of said common council shall direct, and the poles not to be over two hundred and fifty feet apart, and the wires on said poles to be at least where fastened on said poles 20 feet above the earth just beneath, with two pins on said posts for the use of said city for wires for fire alarm purposes only, and that these are the plans and specifications adopted by said mayor and common council for the maintenance and operation of said franchise, and that a certified check of the sum and amount of $200.00 shall accompany all bids as a guarantee of the acceptance of said franchise if granted to the bidder; and shall give bonds to the city in the sum of $200.00 by said bidder conditioned on the building, construction and operation of said plant and franchise within two months after its award and grant by the said common council to the bidder therefor, and that work under said franchise shall commence and continue in good faith under said franchise within one year after it is granted; and if not, then said franchise shall be null and void and of no effect.

And that these resolutions and specifications inviting bids for said franchise be published for three weeks, once each week, in the Fond du Lac Daily Commonwealth, in the Milwaukee Sentinel, and in the Telephone of Chicago, Illinois, to comply with chapter 270 of the laws of Wisconsin for the year 1897.

By order of the common council of Fond du Lac city, Wisconsin.

Dated May 2, A. D., 1898.

T. F. MAYHAM,
Mayor of the City of Fond du Lac, Wisconsin.

Attest: F. A. BARTLETT,
Clerk of the City of Fond du Lac, Wisconsin.

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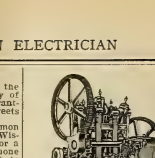

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Notice to Contractors and Builders of Electrical Plants.

Sealed proposals will be received at the office of the New Telephone Company, 803 Stevenson Building, Indianapolis, Indiana, until noon of the sixth day of June, 1898, for the furnishing of materials and labor necessary for the construction of a complete telephone plant in the City of Indianapolis, Indiana.

There will be required in this work, approximately, 250,000 feet of conduit; 200,000 feet of lead-incased cable; 2,000 miles of copper wire, and 3,000 telephones.

Each bidder must submit samples of the materials covered by his proposition.

Bids will be received covering any portion of the work required, as well as upon the plant as a whole.

Each bid must be accompanied by a certified check for $1,000 as a guarantee of good faith. The successful bidder will be required to enter into a satisfactory bond for the completion of the work within nine months from the date of contract.

Plans and specifications may be seen at the office of the company.

New Telephone Company,
H. B. GATES, Secretary.
INDIANAPOLIS, IND., May 20, 1898.

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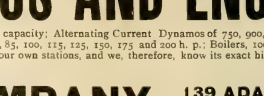

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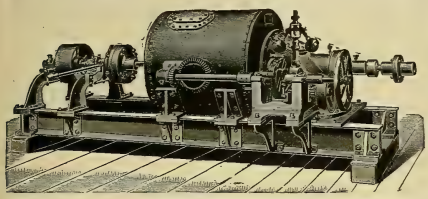

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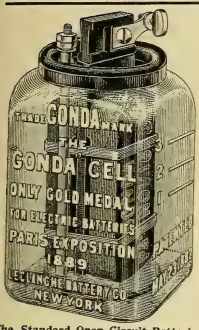

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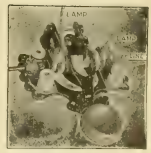

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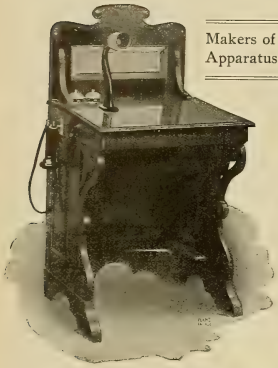

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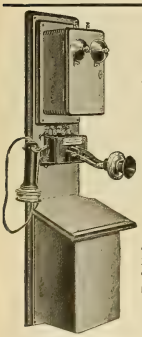

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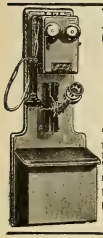

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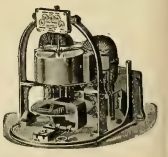

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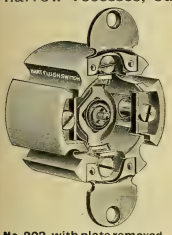

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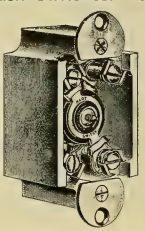

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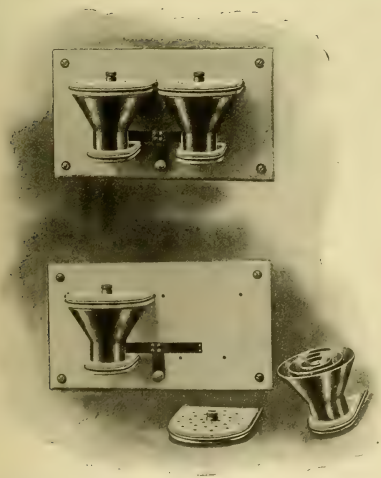

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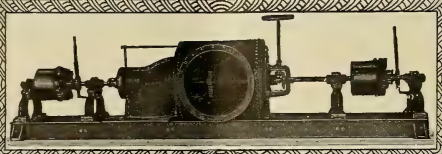

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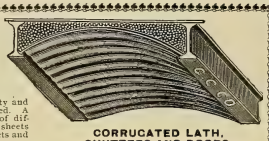

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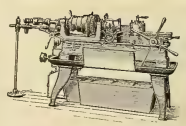

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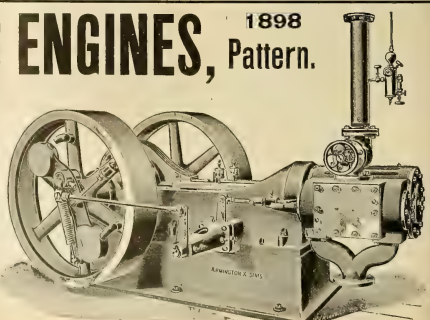

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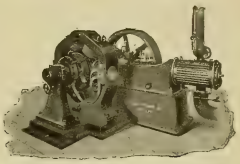

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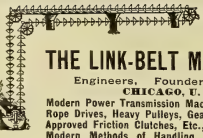

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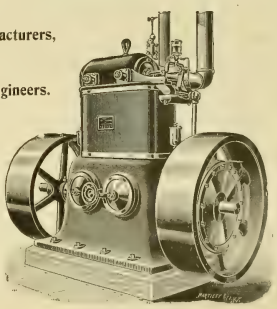

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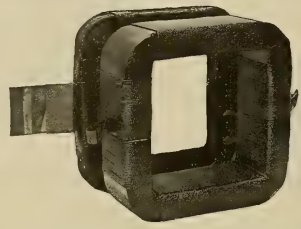

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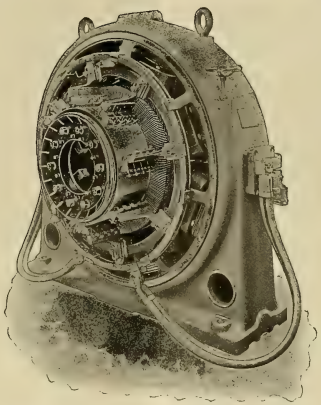

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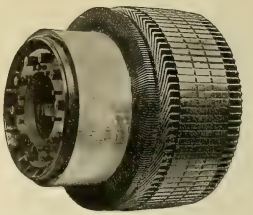

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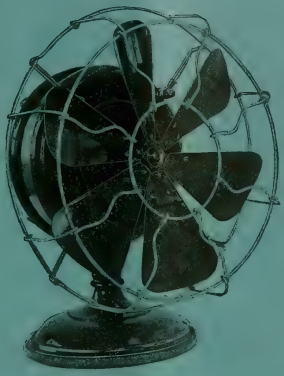

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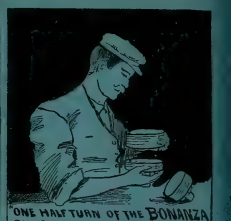

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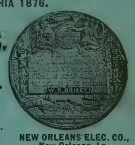

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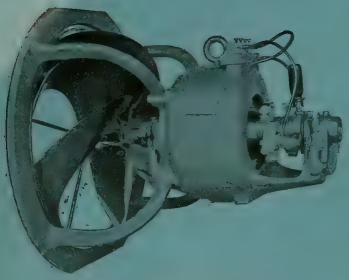

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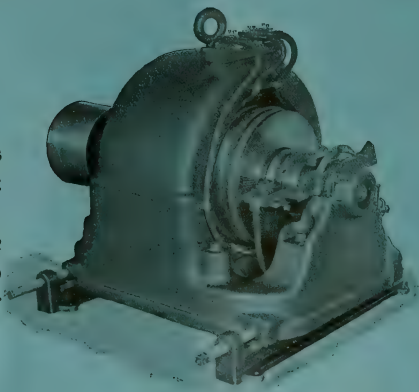

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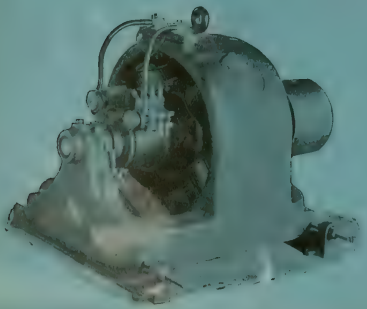

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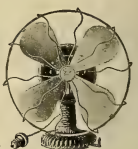

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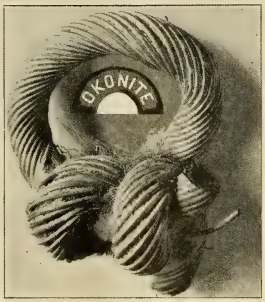

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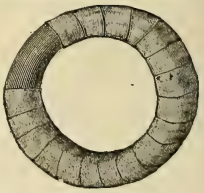

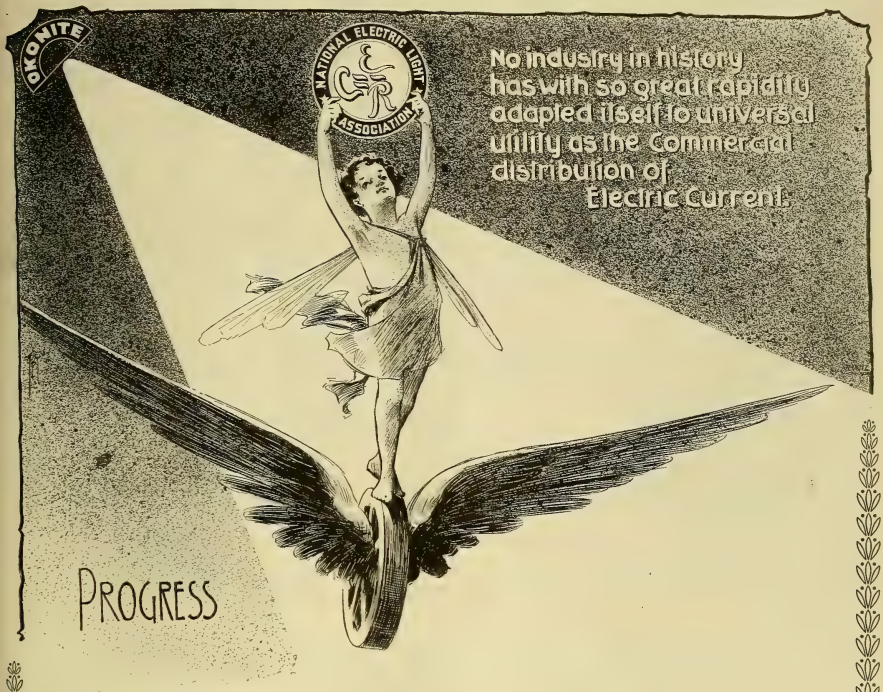

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We are the only rubber-covered wire factory in the West. You will always get the best and save time by sending your orders to us.

We Make a High Grade Duplex Wire for Telephone Connections.

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THE "Chloride Accumulator"
IN CENTRAL STATIONS

secures the maximum efficiency of the power plant. Corrects fluctuations of pressure. Effects a reduction in fuel and labor accounts. Carries the entire load during light hours. Assists the generators during heavy hours. Responds instantly to sudden demands for current. Increases the reliability of the service. Is the most economical method of increasing the capacity of the station.

TYPICAL CENTRAL STATION INSTALLATIONS OF CHLORIDE ACCUMULATORS.

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166 Chloride Accumulators OF 11200 Ampere Hours Capacity.	140 Chloride Accumulators OF 3000 Ampere Hours Capacity.	140 Chloride Accumulators OF 4000 Ampere Hours Capacity.	142 Chloride Accumulators OF 7000 Ampere Hours Capacity.
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120 Chloride Accumulators OF 1000 Ampere Hours Capacity.	126 Chloride Accumulators OF 400 Ampere Hours Capacity.	140 Chloride Accumulators OF 4000 Ampere Hours Capacity.	
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156 Chloride Accumulators OF 6000 Ampere Hours Capacity.	150 Chloride Accumulators OF 4000 Ampere Hours Capacity.	150 Chloride Accumulators OF 4000 Ampere Hours Capacity.	150 Chloride Accumulators OF 4000 Ampere Hours Capacity.

THE ELECTRIC STORAGE BATTERY CO., Drexel Bldg., Philadelphia, Pa.,

CATALOGUES.

SALES OFFICES:— NEW YORK, 20-22 Broad Street. BALTIMORE, 641 Equitable Building. CHICAGO, 1424 Marquette Building. CLEVELAND, O., New England Building. SAN FRANCISCO, 16 Front Street. CANADIAN GENERAL ELECTRIC CO., Ltd., TORONTO, CANADA. BOSTON, 60 State Street

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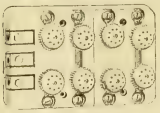

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New Catalogue Out.

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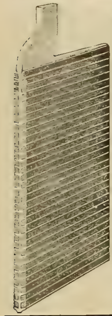

Nature's Laws and — WILLARD BATTERIES Work in Harmony.

What we claim for the Willard Battery is, that its mechanical and electrical construction is so obviously correct that any one familiar with storage batteries of the past and present and their hereditary defects can determine at a glance that all such defects are provided against, and that it is built on lines in such harmony with the inexorable laws of Nature as will insure harmonious action of the parts and consequent long and serviceable life. While we claim electrical superiority in the Willard plate, yet we maintain that the greatest faults of past and present batteries lie in their mechanical construction, and so great are these errors and so general are they, that you will find it difficult to find a storage battery that has lived to a ripe old age and gradually worn out in a theoretically natural way, while the generality will be found to have met with a violent death at an early age, which is directly attributable to their mechanical construction.

The rigid supports in all various styles and shapes lead in promoting havoc, and all of the numerous cases of violence to self is directly due to such like attempts to restrain Nature. The broken supports, shelves, grids, receptacles and pellets, the bending, buckling, warping, and other distortions of the plates, pellets and parts are all the progeny of mechanical restraint. Consequently, one of the greatest features of the Willard plate is its provision for the laws of Nature. Sufficient room is left for the expansion and growth of the active material, and any disposition to restrain Nature is entirely absent: on the contrary, Nature is a full partner in the Willard plate. While other plates are vainly attempting to prevent the expansion occasioned by the electric action and the growth of the active material, and making such poor success as to gradually become more distorted and less recognizable, the Willard having provided for and invited the assistance of Nature, improves with age as the active material increases and only ceases to perform its functions when, after a long period of time, it has in a natural way gradually worn away.

We show on this page a cut of the Willard plate, which will exhibit its construction. It is made from a single piece of pure rolled lead, of the same original thickness throughout. The thin leaves or shelves that you see are integral with the web or support; they are a part of the original plate of lead, and have never been detached therefrom: the angle of the leaves admits of the expansion and growth of the active material, with no ill effects whatever to the plate.

If the reader will call to mind all of the defects in storage batteries that his experience has developed and trace each one back to its source, and compare the troublesome feature with this plate, we think he will find the same is entirely overcome.

We are equipped for the manufacture in large quantities of batteries of all sizes and for all purposes, and we invite anyone interested to examine and test our product, and will supply goods for this purpose at special prices.

SIPE & SIGLER, Cleveland, Ohio.

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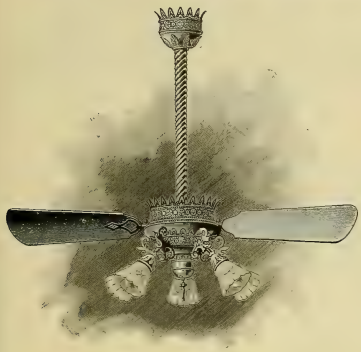

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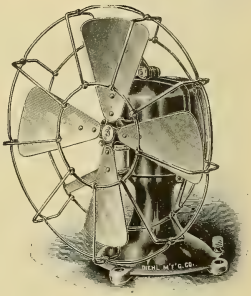

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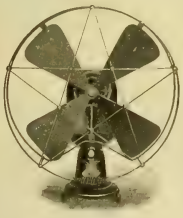


The Roth Fan Motors

Not only keep you cool, but we also guarantee them to be **cheaper than any A! fan on the market.** Correspond with us before placing your order.

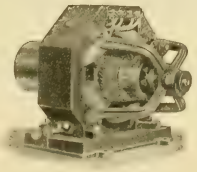
ROTH BROS. & CO.

Manufacturers,

28-30 Market St., Chicago.

Dynamos
and...
Motors,

Slow and medium speed. Highest efficiency and durability guaranteed. In sizes .5 to 10 k. w. Send for illustrated catalog and further information.



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Bracket, Column and Ceiling Fan Motors.

W. E. 1898 FAN

W. E. 1898. 12-in. Desk Fan Motor.

MOTORS,

Made for 110, 220 and 500 volts. Every motor tested at twice its rated voltage.
Every motor guaranteed.
Efficient and Durable.
Ceiling Fans, Column Fans, Desk Fans, Bracket Fans.

Send for Catalog.

Complete description of fans, with illustrations.

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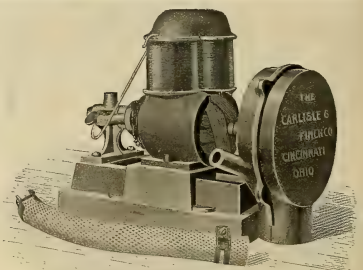
THE HYDRO-ELECTRIC FAN!

SOMETHING NEW.

Will Run on 40 Pounds Water Pressure or Over.

SPEED OF FAN 1800.

WRITE FOR CIRCULAR "C."



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THE "AMERICA."
Patent allowed 1898.

THE only Water Motor that can be adjusted or tilted in any direction while running. Ordinary house supply at 30 lbs. pressure will drive fan, sewing machine, dental engine or dynamo, etc. Motor 7 inches diameter will run over 2,000 revolutions per minute with 50 to 60 lbs. pressure. Price with pulley and brass balance wheel, $13.50 cash; with 12-inch polished brass fan and guard, $14.40 cash. Agents wanted.

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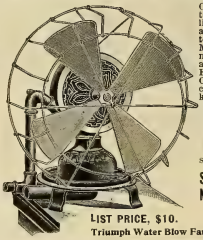
State Water Pressure.

THE ELECTRICIAN'S BEST FRIEND.



Our Fans and Motors are in your line. You sell them and get a new customer. Our Water Motors are the most powerful and are used for running Belt Fans, Telephone Generators, Coffee Mills and other machinery. We manufacture all kinds of fans.

Triumph Water Fans, Ceiling Fans for belt power. **Floor Fans** for belt power. **Triumph Exhaust Fans, Specialty Water Motors, Electric Ceiling Fans.**

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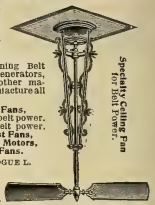

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361 TO 367 S. MERIDIAN STREET,

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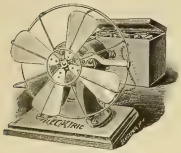
LIST PRICE, $10.

Triumph Water Blow Fan. (Pat. applied for.)

BATTERY FAN OUTFITS



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Complete with cabinet, connecting cords, etc.

150 HOURS

before renewing the battery. 6 inch, 8 inch and 10 inch Fans. 1898 models.

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Edison 9-inch Battery Fan Outfit.....

MOTOR WITH BALL BEARINGS.

The most economical and efficient battery fan motor on the market.

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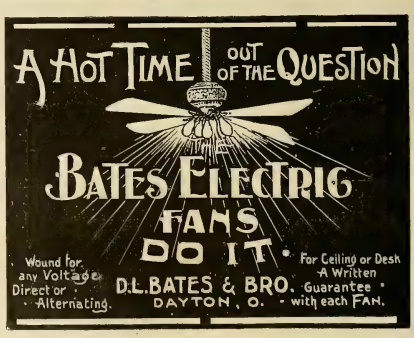
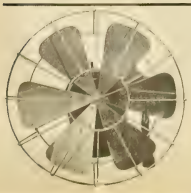
EDISON MFG. COMPANY,

THOS. A. EDISON, Proprietor.

FACTORY: ORANGE, N. J.

St. James Building, Broadway and 26th Street, NEW YORK.





The Gem Water Motor Fan.

Novel in Construction.
As Easily Installed as an Electric Fan Motor.
Discounts for Exclusive Agents.

Simple, Economical, Correspondence Solicited.

Effective, Noiseless.
List Price, $10.00.

JUST THE THING FOR SUPPLY HOUSES TO CARRY.

Agents Wanted.

THE SCHNEIDER MFG. CO., 1134 Hamilton Street, CLEVELAND, OHIO.

McGILL & POMEROY, 321 Dearborn St., Chicago, Ill., Agents for Indiana, Illinois, Missouri, Iowa, Wisconsin, Michigan.

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12-inch Desk ...Fan Motors

Are now made for all voltages
up to and including.....

230 VOLTS.

This to meet the demand.

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Marquette Building.

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Members
National Electric Light
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1898
WELCOME

CHICAGO EDISON COMPANY
STATIONS.
No 1. Harrison St. and Chicago River.
2. 2634 Wabash Ave.
4. Clark and Oak St.
5. cor. Market and Washington.

CROCKER-WHEELER ELECTRIC COMPANY,

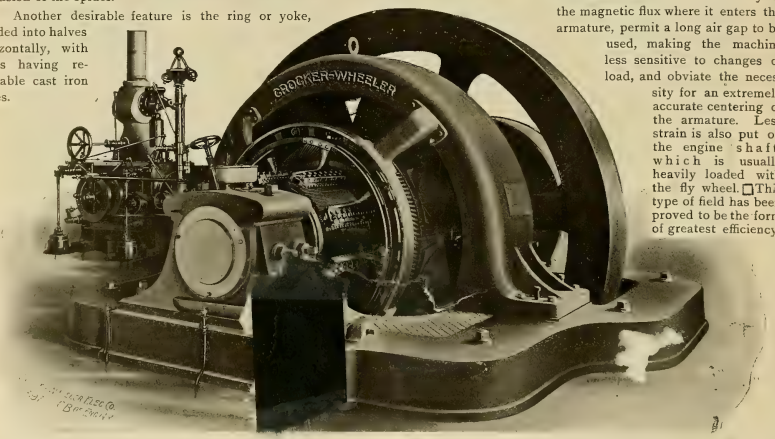
39-41 CORTLANDT STREET, NEW YORK,
AND AMPERE, N. J.

Direct-Connected Power Generators.

THE fine appearance of a perfectly designed dynamo may be the least important feature to be considered, but when the form resulting in pleasing appearance contributes largely to the success of the machine, mechanically and electrically, the desirability of such a feature is twofold. Such a machine of 300 KW capacity, direct-connected to a Corliss engine, is herein illustrated. The frame shows finely rounded lines, but is nevertheless of girder form; the inverted webs or curtains, besides strengthening the ring against collapse, serve to protect the field coils placed between them.

The armature is wound with cables threaded through slots in the periphery of the core, making it thoroughly iron clad and superior to those with bar windings, while the commutator of large diameter and face giving ample capacity is mounted on a sleeve extension of the spider.

Another desirable feature is the ring or yoke, divided into halves horizontally, with poles having removable cast iron shoes. These shoes reduce the density of the magnetic flux where it enters the armature, permit a long air gap to be used, making the machine less sensitive to changes of load, and obviate the necessity for an extremely accurate centering of the armature. Less strain is also put on the engine shaft, which is usually heavily loaded with the fly wheel. ☐ This type of field has been proved to be the form of greatest efficiency.



Brush rigging supported by brackets fastened to the yoke so that it is entirely independent of outboard bearing, with the arrangement of the conductors so that the brushes and holders may be renewed or adjusted while the machine is running, are other of its up-to-date features.

The brush holders are of the parallel movement type, the brush being firmly clamped in a holder which moves radially to and from the commutator, so that the brushes are always perpendicular to the surface of the commutator.

These machines are capable of carrying their full rated current continuously without rising in temperature more than 45° C. above the surrounding atmosphere.

The full load commercial efficiency varies with the size, from 94 per cent. to 88 per cent. The light load efficiency is unsually high.

Although designed principally for use as direct dynamos, these machines can be mounted on frames adapted for the purpose, and used as motors or belted dynamos.

They are made in seven sizes, namely: 300 KW, 200 KW, 150 KW, 100 KW, 75 KW, 50 KW, and 30 KW, varying in speed from 100 to 300 r. p. m.

Speeds, dimensions, weights, prices, and other information, may be had by application to the following Selling Agents:

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Boston: BUBIER-WHITE COMPANY, 19 Federal Street.
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Cleveland: CLEVELAND ELEC. MFG. CO., 98 Sheriff Street.
Toledo, Ohio: F. BISSELL & CO., 116 St. Clair Street.
Columbus, Ohio: J. A. ERNERA CO., 351 N. High Street.
Chicago: CROCKER-WHEELER ELECTRIC CO., 1014 Old Colony Building.
St. Louis: LACLEDE POWER CO., 421 Olive Street.
San Francisco: ABNER DOBLE CO., Fremont and Howard Streets.
Milwaukee: ROHN & MEYER, 418 E. Water Street.
Charlotte, N. C.: ELEC. ENG. & SUPPLY CO., Hunt Building.
New Orleans: NEW ORLEANS ELECTRIC CO., 728 Gruvier Street.
Baltimore, Md.: McCAY ENGINEERING CO., 106 E. German Street.
Minneapolis: W. L. GRAY & CO., Sykes Block, No. 802.
Grand Rapids, Mich.: GRAND RAPIDS ELECTRIC COMPANY.
Bridgeport, Ct.: CROCKER ELECTRIC CO., 50 Middle Street.
Detroit, Mich.: AMERICAN ELECTRIC CO., 251 Randolph Street.
Yokohama, Japan: HAGNALL & HILLES.
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The Standard for Over Ten Years

P & B ELECTRICAL COMPOUND.

P & B INSULATING TAPE.

P & B ARMATURE AND FIELD COIL VARNISH.

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Tried,
Tested,
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Recommended.

This is a
Guarantee
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Superiority.

THE STANDARD [illegible] INT COMPANY,

Manufacture[illegible] P & B Product,

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In Stock by all Dealers.

SUSTAINED CANDLE POWER

Means for the Central Station **SATISFIED CUSTOMERS.** It is the Strong Point of the

HARDY INCANDESCENT LAMP.

To prove it we will express you, charges prepaid, on receipt of order, one dozen 16 C. P: 3 or 3½ watt lamps, any base, any voltage, from 45 to 125, for $2.16. . . . . .

AGENTS WANTED. CORRESPONDENCE SOLICITED.

THE K. & W. COMPANY,

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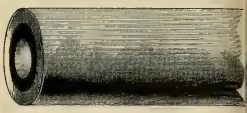
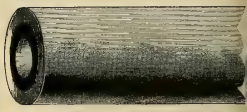
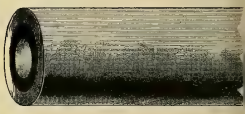
Hardy Incandescent Lamps, Dynamo Brushes, Absolute Cutout Hanger Boards, Commutator Compound, Spark Arresters, Etc.,

PITTSFIELD, MASSACHUSETTS.

COMMERCIAL
ELECTRICAL
SUPPLY CO.
ST. LOUIS







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BUSINESS OF NEW STANDARD DRY BATTERIES,
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POROUS CELL (Carbon Element) ONLY.

Have a superior cell to any in market at a lower price, and my **A No. 1 Cell,** size 6 in. by 2 9-16 in. net, body No. 15 zinc, for life and recuperation has no equal.

Will be pleased to tell you **where** you can get them.

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The Zamel Arc Light Meter

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Is the ONLY RELIABLE DEVICE for Timing the Use of Arc Lights.

It Is Positive in Its Action.

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Zamel Arc Light Meter Co.,

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Approved by the National Fire Underwriters' Association.

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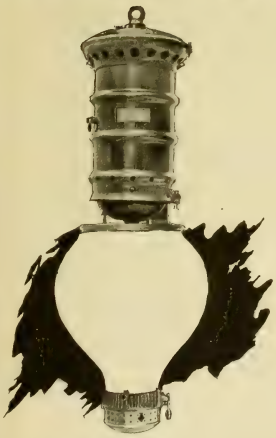

Arc Lamps

FOR

Incandescent Circuits.

PERMANENTLY ADJUSTED TO ANY VOLTAGE DESIRED.

CLUTCH FEED.

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THE WALKER ENCLOSED ARC IS A MOST

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WESTERN ELECTRICIAN'S

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FOR 1898.

TEN CENTS A COPY.

Electrician Publishing Co.,

510 MARQUETTE BUILDING,

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JUST WHAT YOU ARE LOOKING FOR!

A New and Valuable Book

Electric Lighting Plants,

THEIR COST AND OPERATION.

By W. J. Buckley. With numerous illustrations, diagrams, plans, tables, etc. 275 pages. Cloth. Price, $2.00, postage free. This work gives all necessary data for the erection of an electric light plant of any size. The cost of Arc Lighting. The cost of Incandescent Lighting.

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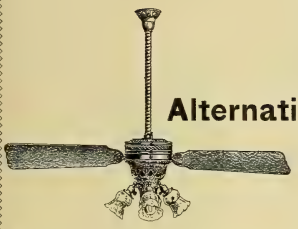
Alternating and Direct Current.



Direct Current.

Made for two speeds, 135 and 190 revolutions.
Sweep of blade, 60 inches; width 8 inches.
Made for 110, 170, 220, 500 volts, with or without Electrolier.

High Economy,
Self-Oiling Bearings,
Adjustable Blades,
Starting Switch
at Bottom.

Hunter Fan & Motor Co.

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WALKER & KEPLER,
Philadelphia, Pa.

Alternating Current.

Speed 150 revolutions. Sweep of Blades, 5 feet;
Width of blades, 8 inches.
Made for 60, 125 and 140 cycles, 52 to 120 volts.

THE BRUSH ELECTRIC COMPANY

BRUSH

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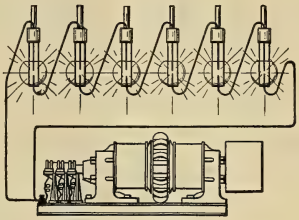
Brush apparatus has been on the market for twenty years. A majority of customers order supply parts direct from us. Many do not. We want this trade and are reducing our prices in order to secure it. Ask for quotations and send orders to the nearest Sales Office.



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St. Louis, Mo., Wainwright Building.
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Denver, Colo., Kittredge Building
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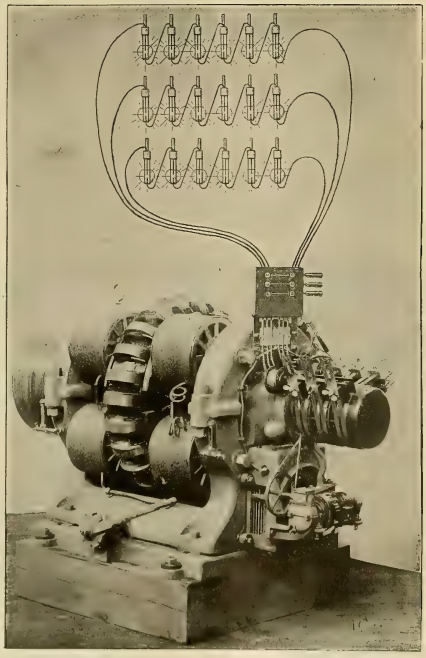
Many stations have exchanged all their small units for large Brush arc dynamos. Among them in lights' capacity are:

Buffalo	4,250
Brooklyn-Citizens	3,360
Newark, N. J.	3,000
New Orleans	2,250
Cleveland	2,150
Philadelphia Brush	1,500
New York City	1,375
Philadelphia-Northern	1,300
Brooklyn-Municipal	1,200
Worcester	1,000
Washington, D. C.	1,000
Toronto	900
Harrisburg	750
Malden, Mass	720
Cambridge, Mass.	720
Norfolk, Va	720
City of Chicago	700
Boston, Mass	660
Quebec	625
Paterson	625
John Wanamaker	625
Brooklyn, Kings Co.	625
Rockford, Ill	625
Erie	500
Albany	500
Troy	500
Carnegie Steel Co.	500
Manchester, N. H.	500
Reading, Pa.	500
Montgomery, Ala	480



BRUSH MULTI-CIRCUIT 125-LIGHT ARC DYNAMO—1898.

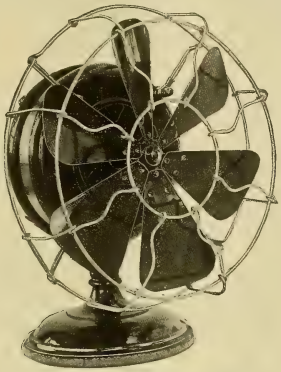
Over 60,000 lights' capacity in large Brush arc dynamos sold. A large proportion of them using Multi-Circuit Dynamos.

The newly designed Brush dynamos have the following capacities: 55, 80, 100, 125, 240, 300, 2,000 candle power lights; 45, 85, 120, 160, 1,200 candle power lights.

Brush arc lamps were first used in 1877. More of them being sold to-day than ever before.

Two or more separate circuits run direct from one dynamo with any distribution of load on the different circuits. The advantages are absolute flexibility in handling of circuits; reduction of high voltages on circuits run from large dynamos; use of large units with corresponding increase of efficiency; saving in floor space, oil, belts, shafting, pulleys, attendance.

Manufacturers of the STANDARD ELECTRICAL APPARATUS of the World



Manufacturers of the STANDARD ELECTRICAL APPARATUS of the World

'98 Model

'98 Model

G. E. Fan Motors

The Alternating Current Fan Motors run on 52 or 104 Volt Circuits, 60 or 125 Cycle Frequencies.

No Brushes, No Commutator.

The Direct Current Fan Motors run on Incandescent Lighting Circuits of 110 Volts.

Enclosed Commutator, Enclosed Brushes.

VARIABLE SPEED,
NO HEATING,
NO SPARKING,
NO OIL THROWING,
NO NOISE.

NO EXPERIMENT,

JUST A FAN MOTOR GUARANTEED TO GIVE PERFECT SATISFACTION.

General Electric Company,

PRINCIPAL OFFICES, SCHENECTADY, N. Y.

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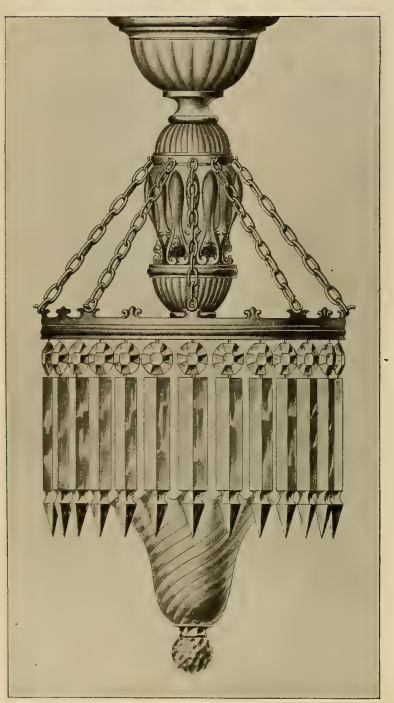
For all business outside the United States and Canada: Foreign Department, Schenectady, N. Y., and 44 Broad Street, N. Y.

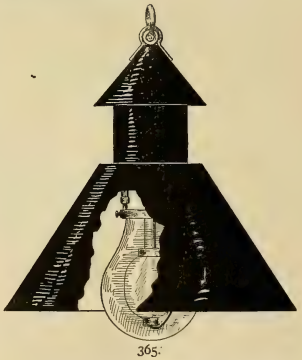
For Canada, address Canadian General Electric Company, Ltd., Toronto, Ontario.

MacINTIRE ARC LAMPS.



347.
PRISMATIC ARC LAMP. Long Life.
With Canopy. Drop from Ceiling, 22 Inches.

347.
REFLECTOR LAMP FOR LOW CEILINGS.



365.
OUTSIDE REFLECTOR LAMP.

THE records established by the MacIntire Arc Lamp in the past and lately emphasized at the Electrical Show at Madison Square Garden, May 1st to 4th, have demonstrated a most radical departure in Arc Lamp architecture and have stamped them, in construction and high efficiency, a vast and sweeping advance in the Arc Lamp world. Our lamps for all service, large and small interiors, street and park illumination, are unsurpassed. They have received the highest commendations from the public at large, the press, electrical engineers and experts, from Europe as well as the United States.

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THE INTERNATIONAL ARC LAMP CO.,

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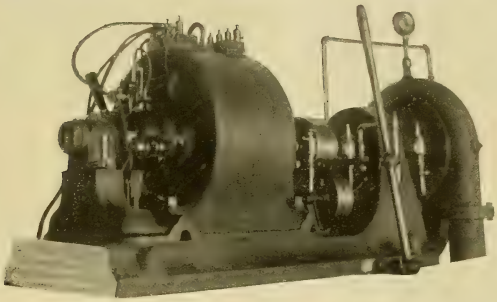

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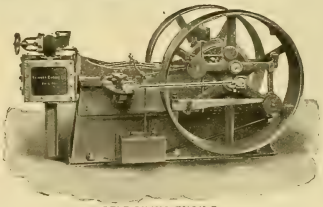

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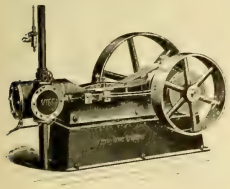

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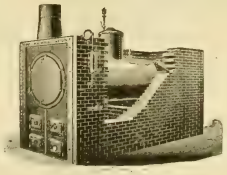

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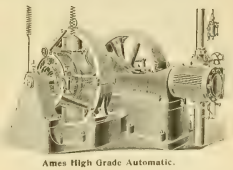

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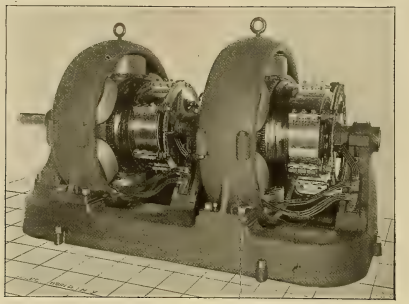

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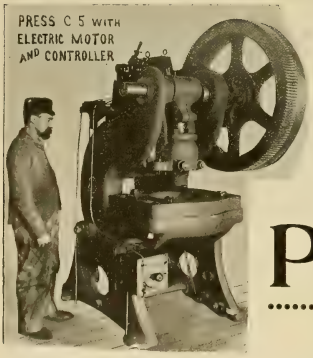

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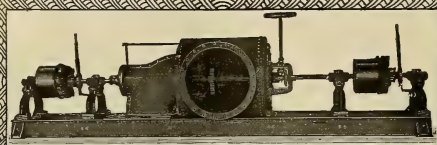

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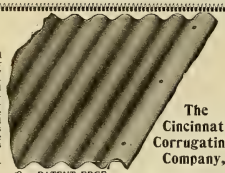

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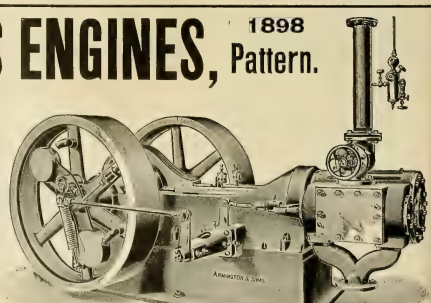

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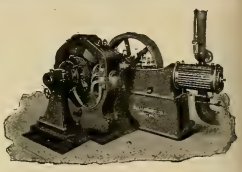

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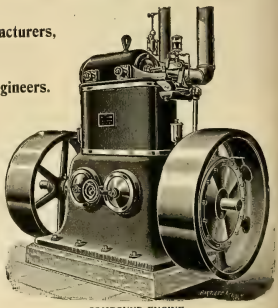

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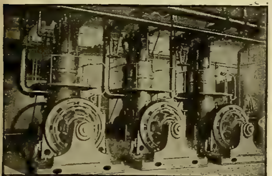

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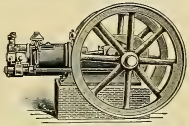

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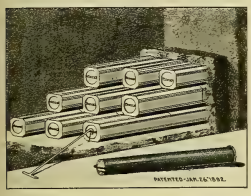

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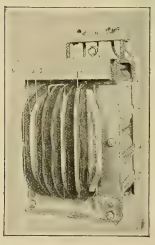

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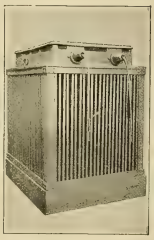

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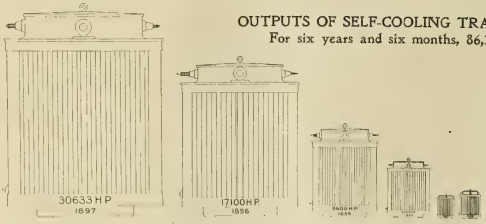

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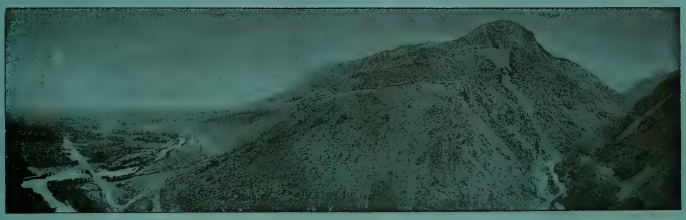

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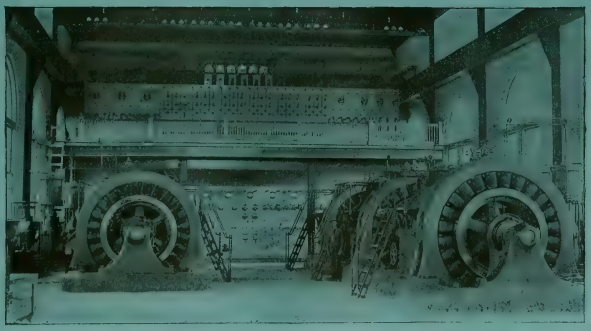

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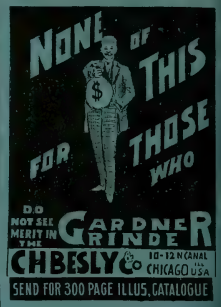

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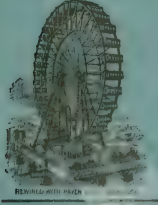

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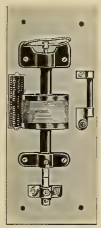

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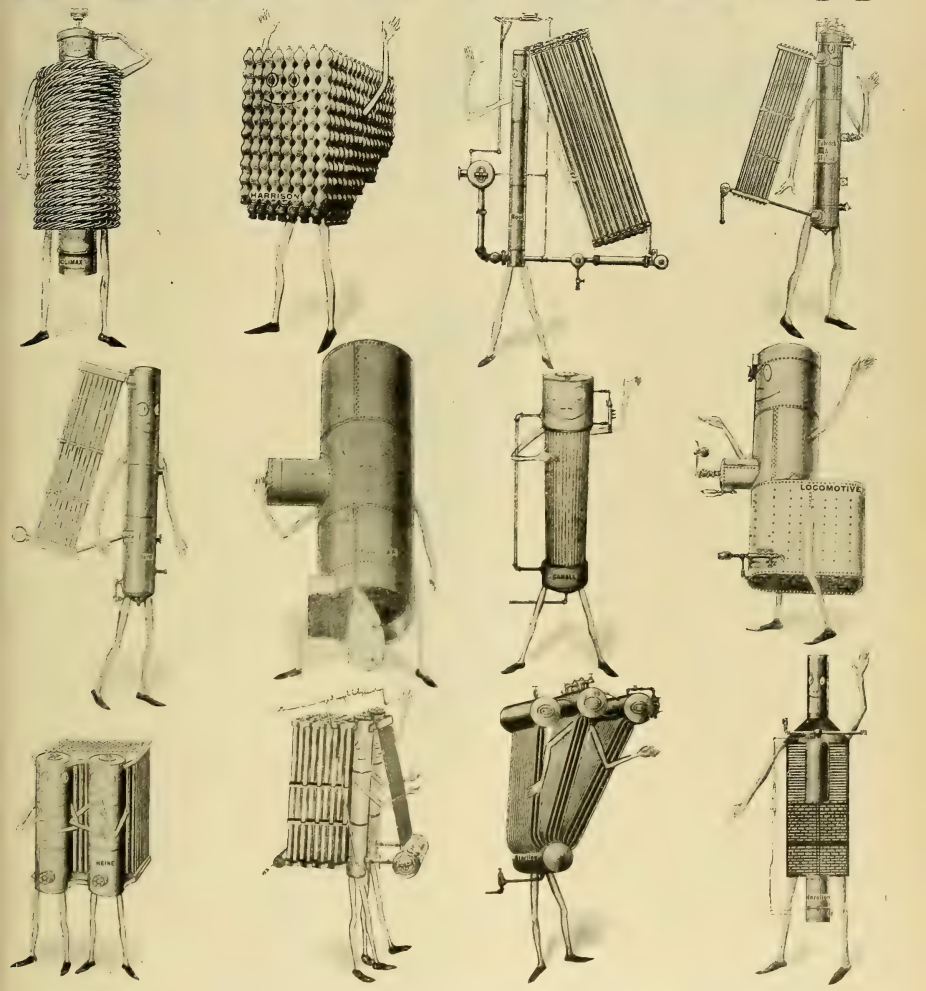

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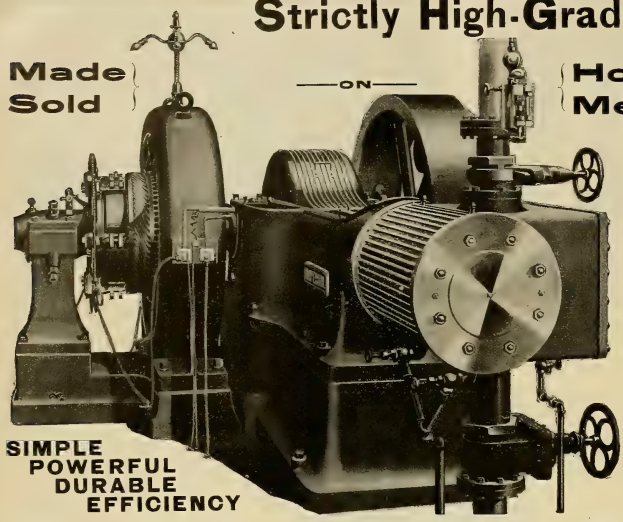

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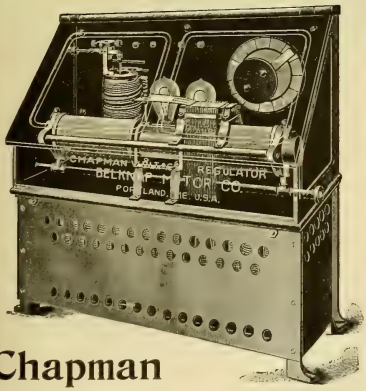

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Is crying for Out-Let Boxes to-day?
To have the Ward Leonard Co.'s is his desire,
For these are the ones that protect against fire.

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So **BLANCO** can't communicate
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With powder and shrapnel and soldiers and meat.

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Strategist **MILES** will ride at their head
On Helios' chariot which **Spaniards** will dread;
Then there'll be light, bright light and fight,
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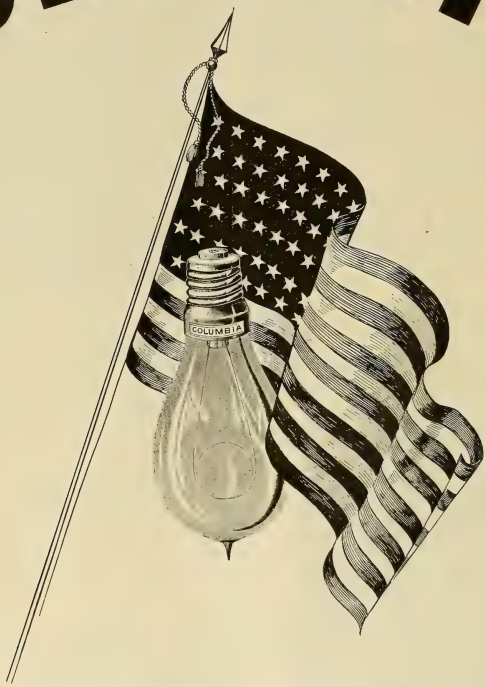

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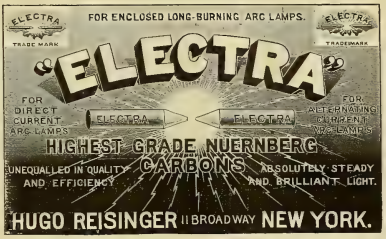

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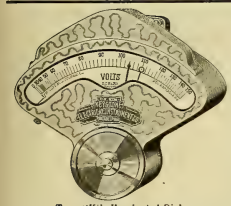

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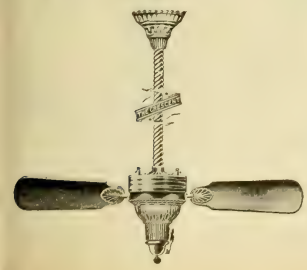

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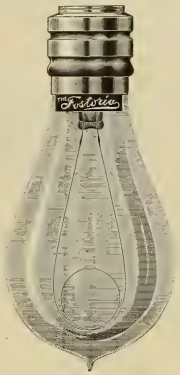

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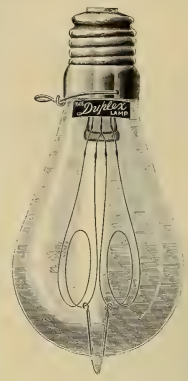

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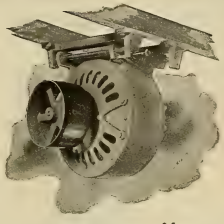
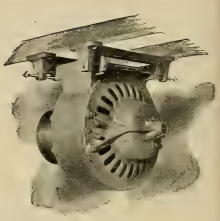

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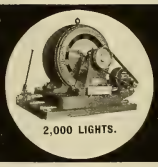

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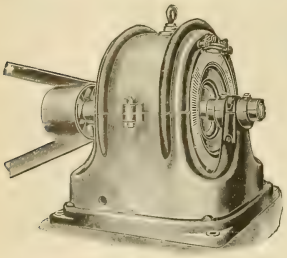

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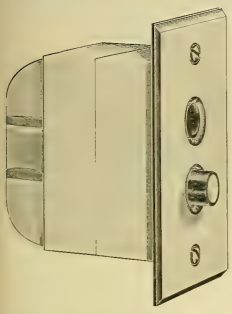

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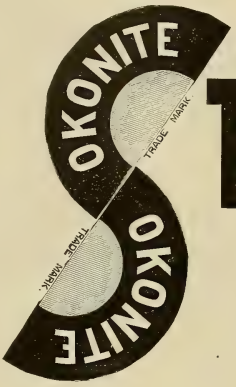

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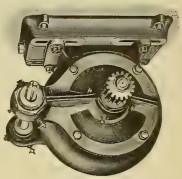

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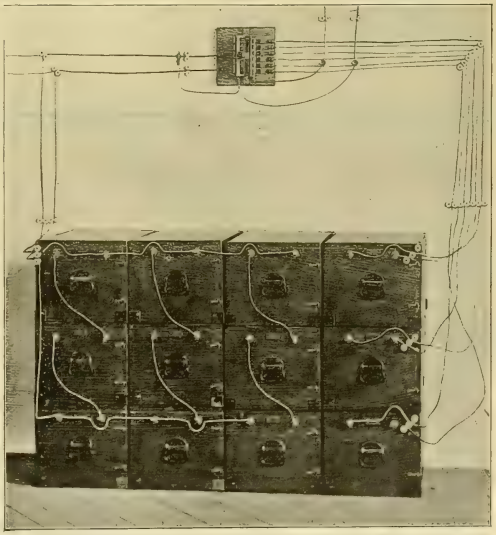

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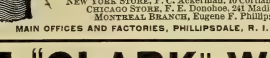

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Having had many years' experience in the electrical business and enjoying an extensive and valuable business acquaintance in that line throughout the entire West, from the Pennsylvania line to Pacific coast, North and South, including the Sandwich Islands and West Indies, I would like to identify myself with a good electrical house or manufacturing company as general or special Western Sales Agent. Can command a good trade, pass on credits, and handle municipal business, etc.

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NOTICE.

Plans and specifications adopted by the mayor and common council of the city of Fond du Lac, Wisconsin, relative to granting a telephone franchise on certain streets in said city.

Resolved, By the Mayor and Common Council of the city of Fond du Lac, Wisconsin, That whereas, an application for a franchise has been made for a telephone line along and upon Scott street west to Doty street, south on Doty street to Division street, thence east on Division street to Macy street, thence south on Macy street to Forest avenue, thence east on Forest avenue to the alley between Macy and Main streets, thence south on said alley to Remington Company's drug store in said city; and whereas, the franchises in said city must be by law sold and granted to the highest bidder therefor, therefore notice is hereby given to all whom it may concern or who may wish to bid for said franchise for said telephone line in said city, that bids therefor will be received sealed by the said common council of said city up to 8 o'clock p. m. of Monday, June 6th, 1898, addressed to City Clerk, F. A. Bartlett, Esq., Fond du Lac, Wisconsin.

And that the said franchise will on said date be granted to the highest and best bidder therefor, according to the plans and specifications now on file in the said city clerk's office.

That not more than $1.50 a month shall be charged to private houses, nor more than $2.50 to business houses per month, under said franchise, that the manager and treasurer of said company operating said franchise must once each year make oath and file with said common council a verified statement of the gross receipts for such business carried on under said franchise; and said bidder shall pay what percentage the bidder will pay on the gross receipts a year under said franchise, if granted to him, into the treasury of said city for the use of said city; said telephone line or lines on said streets to be erected on poles firmly set in the ground where the street committee of said common council shall direct, and the poles not to be over two hundred and fifty feet apart, and the wires on said poles to be at least where fastened on said poles 30 feet above the earth just beneath, with two pins on said posts for the use of said city for wires, for fire alarm purposes only, and that these are the plans and specifications adopted by said mayor and common council for the maintenance and operation of such franchise, and that a certified check of the sum and amount of $200.00 shall accompany all bids as a guarantee of the acceptance of said franchise if granted to the bidder; and shall give bonds to the city in the sum of $500.00 by said bidder conditioned on the building, construction and operation of said plant and franchise within two months after its award and grant by the said common council to the bidder therefor, and that work under said franchise shall commence and continue in good faith under said franchise within one year after it is granted; and if not, then said franchise shall be null and void and of no effect.

And that these resolutions and specifications inviting bids for said franchise be published for three weeks, once each week, in the Fond du Lac Daily Commonwealth, in the Milwaukee Sentinel, and in the Telephone of Chicago, Illinois, to comply with chapter 370 of the laws of Wisconsin for the year 1897.

By order of the common council of Fond du Lac city, Wisconsin.

Dated May 3, A. D. 1898.

T. F. Mayham,
Mayor of the City of Fond du Lac, Wisconsin.

Attest: F. A. Bartlett,
Clerk of the City of Fond du Lac, Wisconsin.

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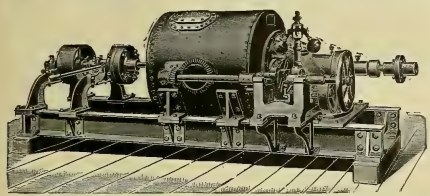

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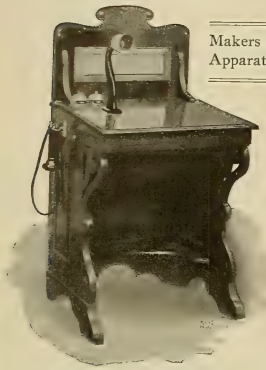

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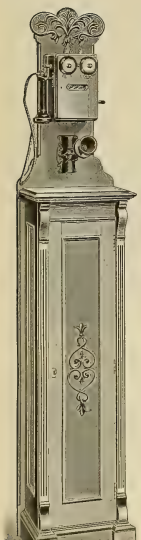

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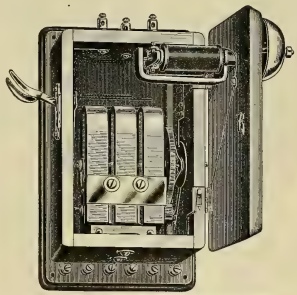

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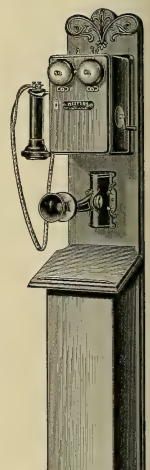

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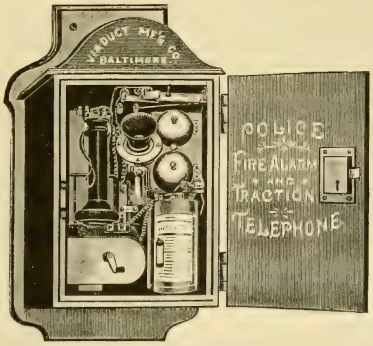

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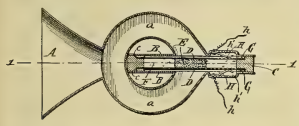

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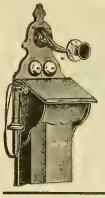

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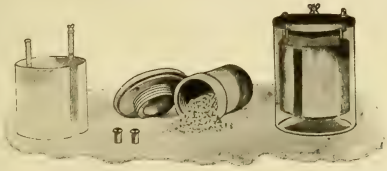

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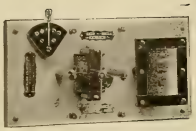

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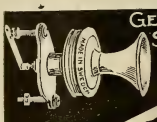

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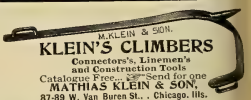

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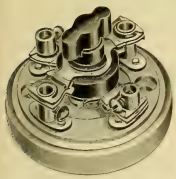

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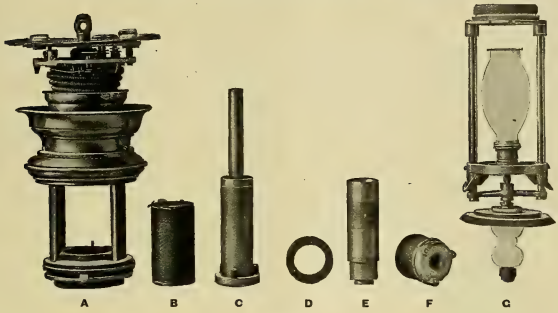

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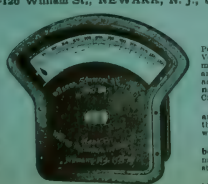

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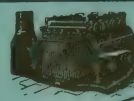

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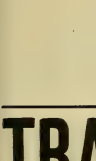

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

CHICAGO EDISON COMPANY,

76 MARKET STREET, CHICAGO.

The Phoenix Glass Co.

OF PITTSBURG, PA.,

HAS REMOVED

its **New York Office** to

15 Murray Street

FRANKLIN BUILDING,

where all the extensive and various lines of **The Phoenix Glass Company's** well-known manufacture are on exhibition, consisting of **Arc and Incandescent Electric Globes and Shades,** Gas and Kerosene **Globes and Shades, Decorated Vase Lamps, &c.**

"SHIP CARBONS"

Made in NUERNBERG and VIENNA.

Are absolutely of the Highest Grade, and cannot be equalled. See that every Carbon bears our

TRADE MARK

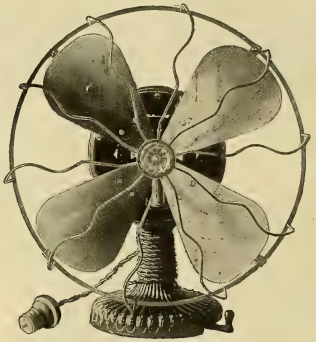
Special Carbons for Long-Burning Arc Lamps. Carbons for Direct and Alternating Current Lamps, Search Lights, etc. WRITE FOR PRICES.

SCHIFF, JORDAN & CO.,

232-234 GREENWICH STREET, - - - NEW YORK.

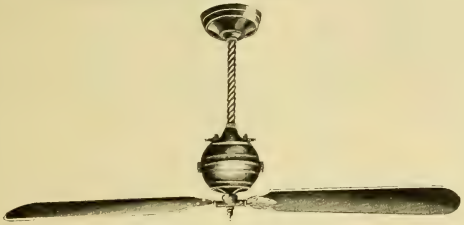
ATMOSPHERIC ACCELERATORS.

Westinghouse Alternating Fan Motors.



50 and 100 Volts. 7200-1600 Alternations.
13 Inch Blades.

IN CHICAGO STOCK.



SENIOR CEILING FAN MOTOR.

The Senior Ceiling Fan Motor

is the only motor suitable for continuous operation on 500 volt circuits.

Lundell Direct Current Fan Motors

12 INCH AND 16 INCH

Desk and Bracket.

GET OUR LATEST PRICES.

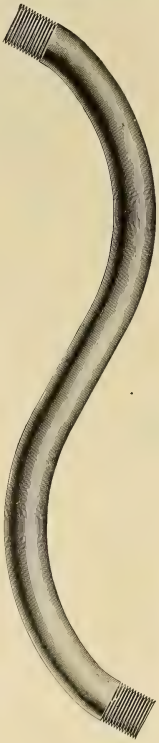
CENTRAL ELECTRIC COMPANY,

GEORGE A. McKINLOCK, President.
CHARLES E. BROWN, Secretary.
S. R. FRAZIER Treasurer.

264, 266, 268, 270 Fifth Avenue,
.....CHICAGO.

IRON ARMORED INTERIOR CONDUIT.

Introduced and standardized by Interior Conduit and Insulation Company.



NEW PRICES.

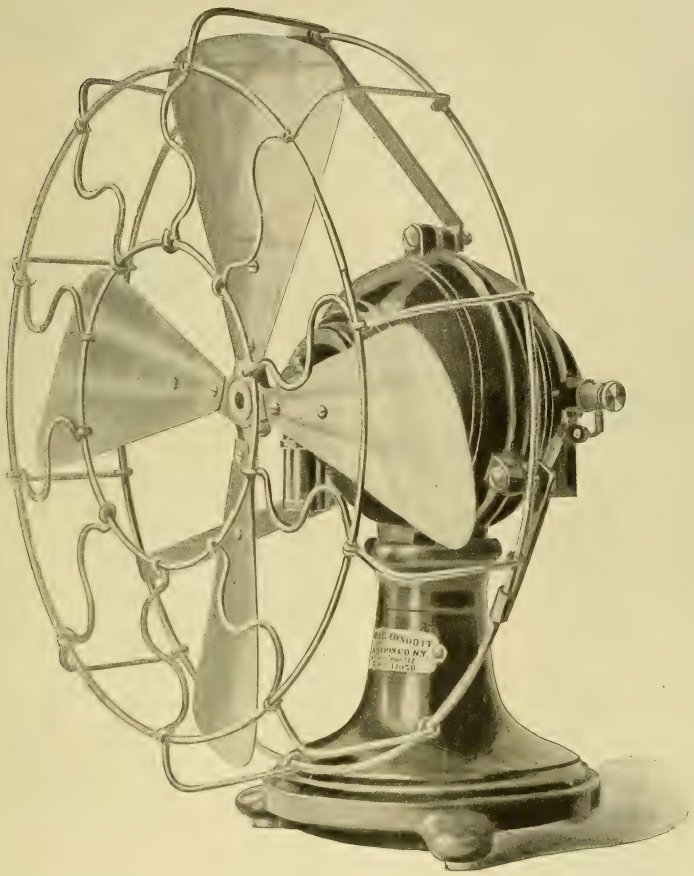
UNEQUALLED PRODUCT.

This conduit has earned for itself the favor of the U. S. Government, Insurance Experts and thousands of builders all over the country.

The only conduit which has proved its worth during years of practical use. Competitive tests have only emphasized its superiority.

SPRAGUE ELECTRIC COMPANY,

CHICAGO---Marquette Bldg. **NEW YORK CITY---20 Broad St.**

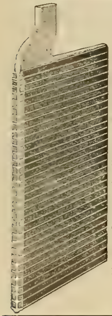


1898 **Lundell Fan Motors.** 1898

Advance orders, greatest in the history of the business, attest the popularity of these motors. They are the world's standard. '98 styles are—some of them—new. '98 prices are lower than ever. Catalogue—second edition—just out.

SPRAGUE ELECTRIC COMPANY,

CHICAGO—Marquette Building. NEW YORK—20 Broad Street.



Nature's Laws and—

WILLARD BATTERIES

Work in Harmony.

What we claim for the Willard Battery is, that its mechanical and electrical construction is so obviously correct that any one familiar with storage batteries of the past and present and their hereditary defects can determine at a glance that all such defects are provided against, and that it is built on lines in such harmony with the inexorable laws of Nature as will insure harmonious action of the parts and consequent long and serviceable life. While we claim electrical superiority in the Willard plate, yet we maintain that the greatest faults of past and present batteries lie in their mechanical construction, and so great are these errors and so general are they, that you will find it difficult to find a storage battery that has lived to a ripe old age and gradually worn out in a theoretically natural way, while the generality will be found to have met with a violent death at an early age, which is directly attributable to their mechanical construction.

The rigid supports in all various styles and shapes lead in promoting havoc, and all of the numerous cases of violence to self is directly due to such like attempts to restrain Nature. The broken supports, shelves, grids, receptacles and pellets, the bending, buckling, warping, and other distortions of the plates, pellets and parts are all the progeny of mechanical restraint. Consequently, one of the greatest features of the Willard plate is its provision for the laws of Nature. Sufficient room is left for the expansion and growth of the active material, and any disposition to restrain Nature is entirely absent; on the contrary, Nature is a full partner in the Willard plate. While other plates are vainly attempting to prevent the expansion occasioned by the electric action and the growth of the active material, and making such poor success as to gradually become more distorted and less recognizable, the Willard having provided for and invited the assistance of Nature, improves with age as the active material increases and only ceases to perform its functions when, after a long period of time, it has in a natural way gradually worn away.

We show on this page a cut of the Willard plate, which will exhibit its construction. It is made from a single piece of pure rolled lead, of the same original thickness throughout. The thin leaves or shelves that you see are integral with the web or support; they are a part of the original plate of lead, and have never been detached therefrom: the angle of the leaves admits of the expansion and growth of the active material, with no ill effects whatever to the plate.

If the reader will call to mind all of the defects in storage batteries that his experience has developed and trace each one back to its source, and compare the troublesome feature with this plate, we think he will find the same is entirely overcome.

We are equipped for the manufacture in large quantities of batteries of all sizes and for all purposes, and we invite anyone interested to examine and test our product, and will supply goods for this purpose at special prices.

SIPE & SIGLER, Cleveland, Ohio.

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Aluminum Castings.
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Westinghouse El. & Mfg. Co.
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Batteries and Jars.
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Burnley Batt. & Mfg. Co.
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Gordon-Burnham Battery Co
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L. P. & D. Transmitter Co
Main Belting Co.
Munson Bros. Belting Co.
Peerless Rubber Mfg. Co.
Shultz Belting Co.
Boilers.
Ames Iron Works.
Armington & Sims Co.
Westinghouse, Church, Kerr & Co.
Books, Electrical.
Electrician Publishing Co.
Brass Founders and Finishers Metal Patterns
Moser & Wilson.
Bridges, Floors, Cranes.
Berlin Iron Bridge Co.
Brushes.
Central Electric Co.
Commercial El. Supply Co.
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K. & W. Company.
Ohio Elec. Specialty Mfg Co.
Buildings and Roofing.
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Central Electric Co.
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Mass. Chemical Co.
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Standard Paint Co.
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Michigan Pipe Co.
Construction & Repairs.
Akron Elec. Mfg. Co.
Bullock Elec. Mfg Co.
Chicago Edison Co.
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Hodge, Walsh & Loring.
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Walker Company.
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Northern Electl. Mfg. Co
Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
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General Elec. Co.
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Barnett Co., G. & H.
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Edwards, W. S. Mfg Co.
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Chicago Edison Co.
Commercial El. Supply Co
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Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co
Illinois Electric Co.
Kartavert Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
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Standard Paint Co.
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American Engine Co.
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Bullock Elec. Mfg. Co.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation
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Hobart Elec. Mfg. Co.
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Sprague Electric Co.
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Phosphor Bronze.
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Phosphor Bronze Sm. Co. Ltd
Platinum.
Baker & Co.
Poles.
Baily Mfg. Co.
Berthold & Jennings.
Central Mfg Co.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pipe Company.
Perrizo & Sons.
Pittsb. & L. Sup. Iron Co.
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Torrey Cedar Co.
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Akron Ins. & Marble Co.
Central Electric Co.
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Chicago Edison Co.
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Cornman Co.
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Hine & Co., L. A.
Hodge, Walsh & Loring.
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Partrick, Carter & Wilkins.
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Queen & Co.
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Cabinet Mfg. Co.
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Rawson Electric Co.
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Westinghouse El. & Mfg. Co
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Dayton Globe Iron Works Co
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Pelton Water Wheel Co.
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Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
Western Electric Co.
Woodwork, Electrical.
Cabinet Mfg. Co.
X Ray Outfits.
Central Electric Co.
Commercial El. Supply Co
Queen & Co.

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DIEHL FANS

FOR ALL CIRCUITS, EXCEPT ALTERNATING.

OUR CEILING FANS AND ELECTROLIERS
ARE THE

Recognized Standard
OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

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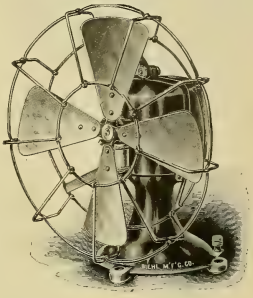

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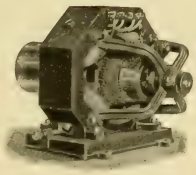

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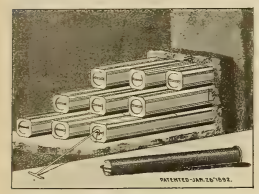

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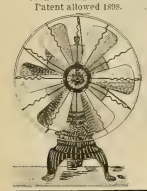

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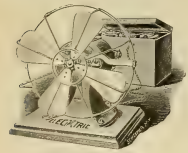

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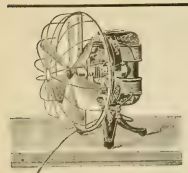

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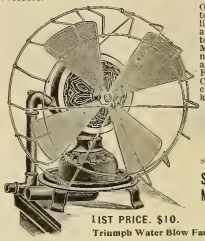

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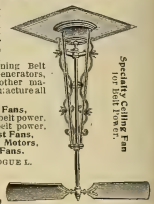

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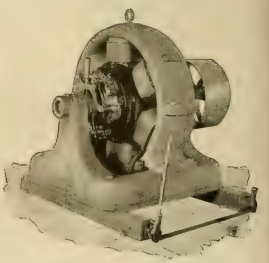

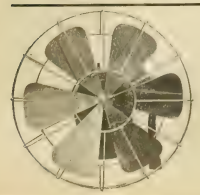

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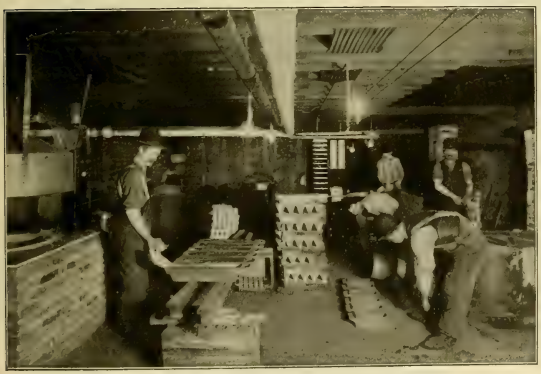

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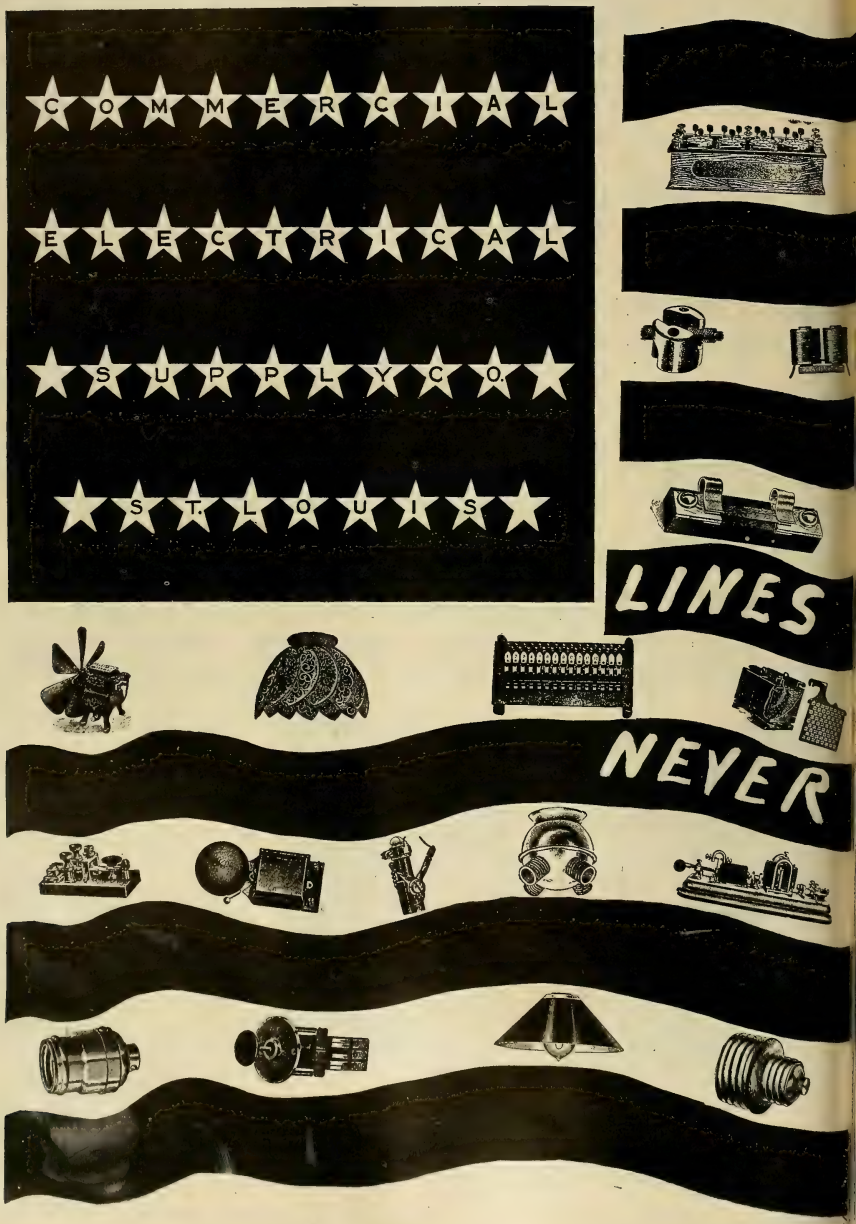
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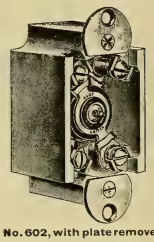

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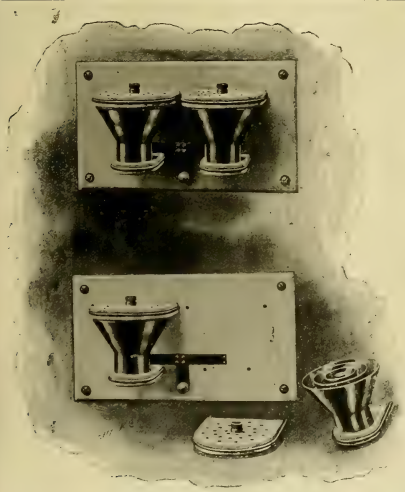

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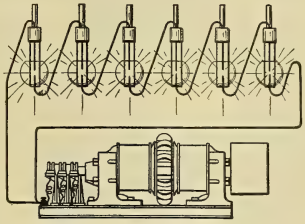

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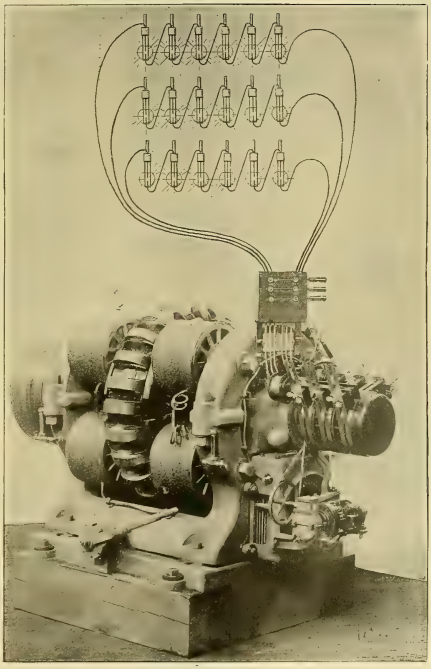

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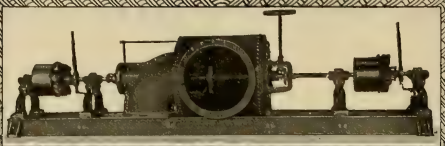

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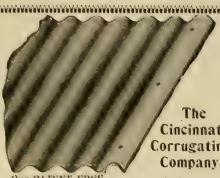

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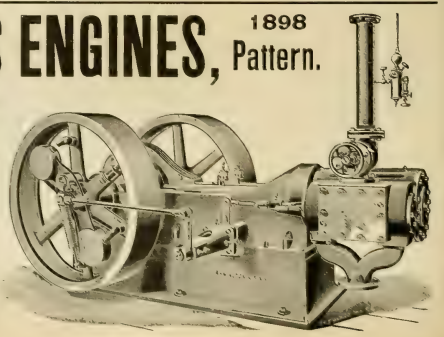

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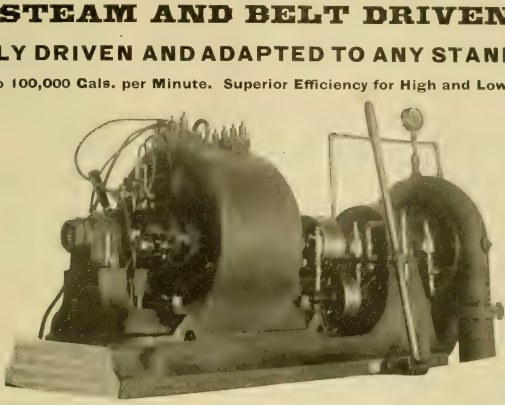

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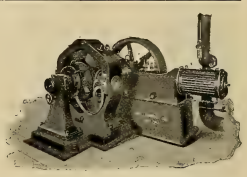

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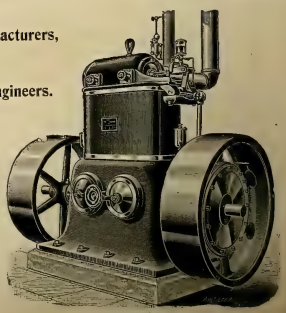

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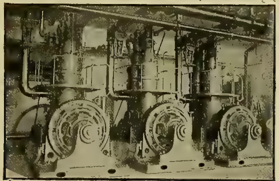

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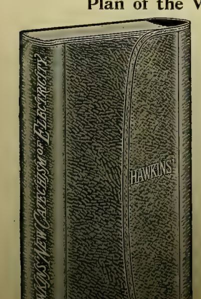

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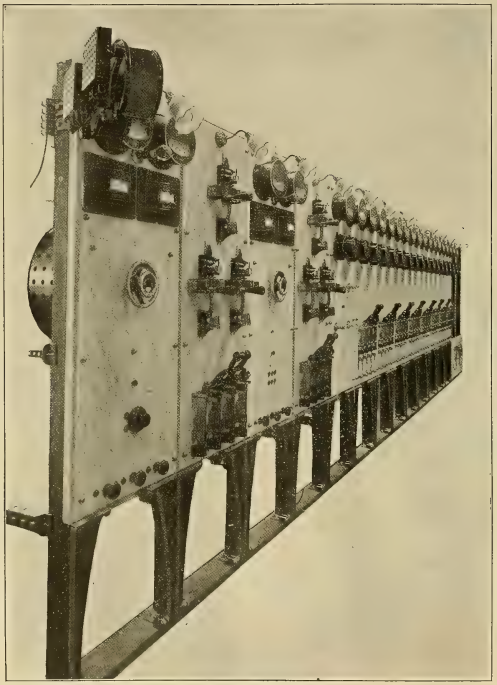

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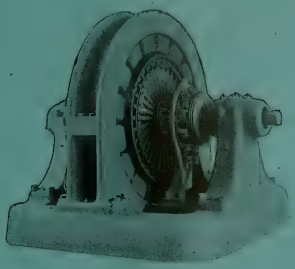

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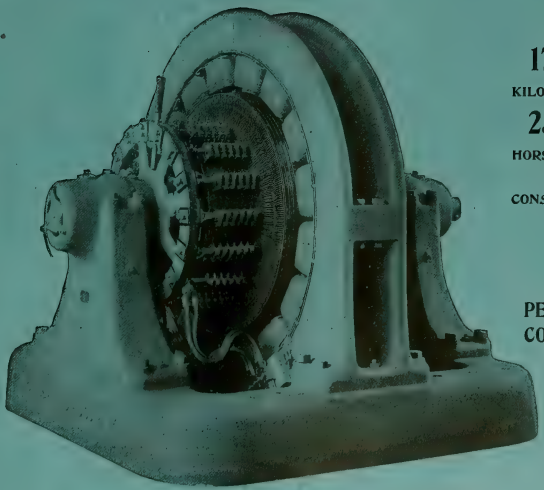

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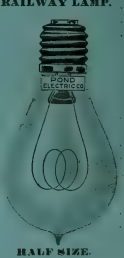

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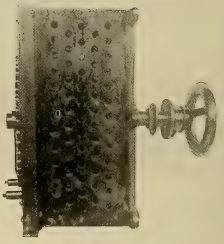

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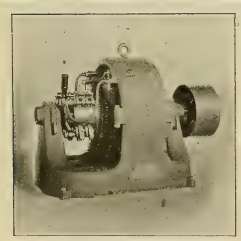

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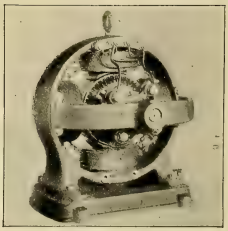

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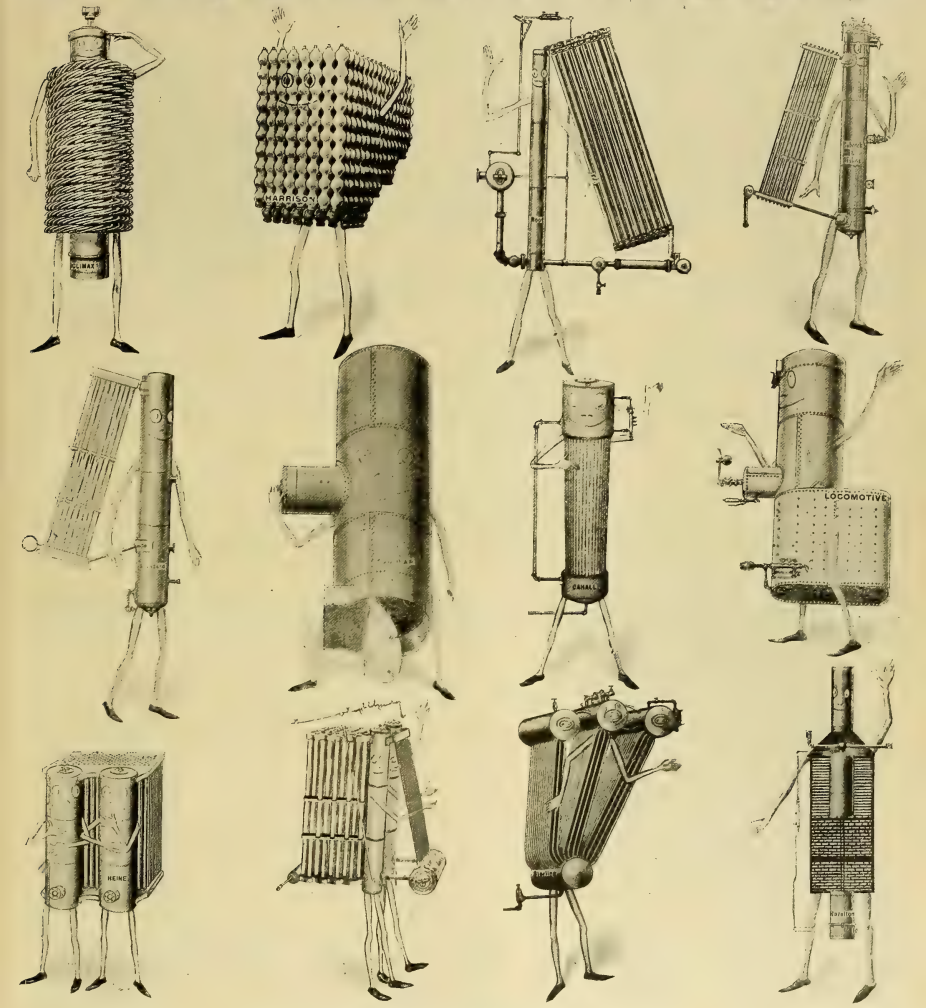

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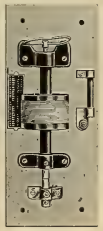

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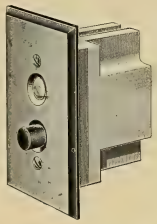

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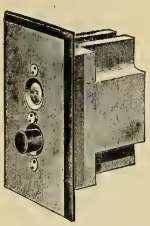

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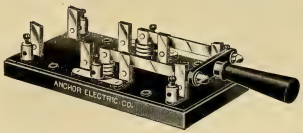

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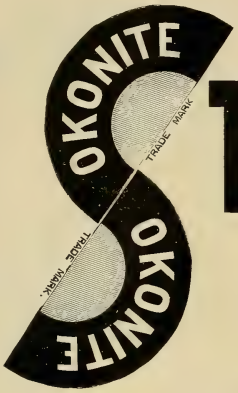

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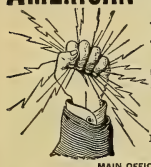

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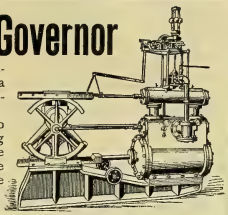

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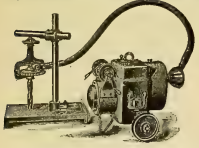

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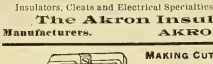

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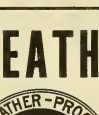

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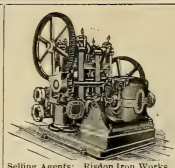

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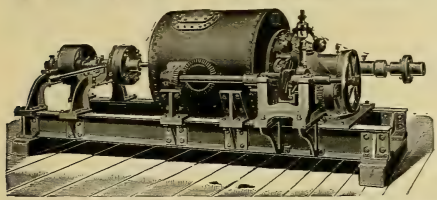

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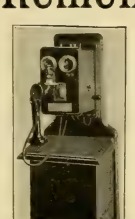

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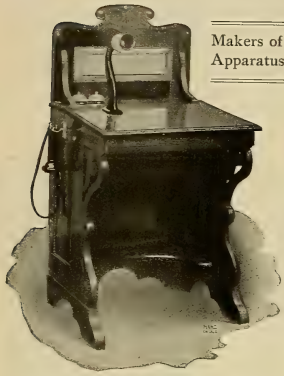

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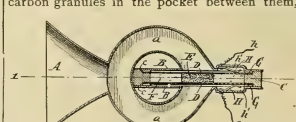

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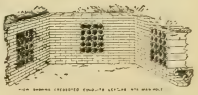

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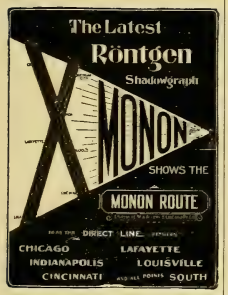

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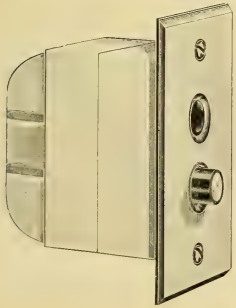

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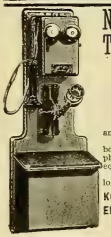

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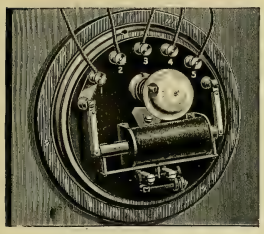

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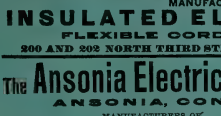

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Means for the Central Station **SATISFIED CUSTOMERS.** It is the Strong Point of the

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To prove it we will express you, charges prepaid, on receipt of order, one dozen 16 C. P. 3 or 3½ watt lamps, any base, any voltage, from 45 to 125, for $2.16. . . . . .

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The CENTRAL ELECTRIC Co.

MANUFACTURERS, IMPORTERS AND JOBBERS IN **Electrical Supplies**

CHICAGO.

OKONITE TRADE MARK

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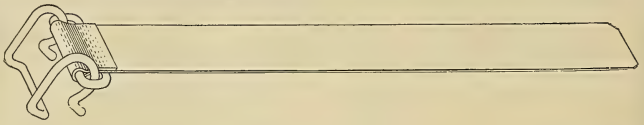
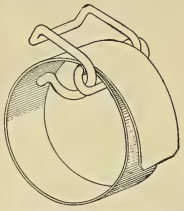
Howes Line Wire Tool.

A handy tool for a man up a pole—good as a third hand.

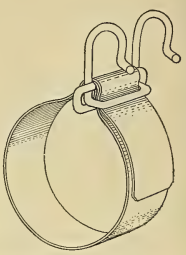


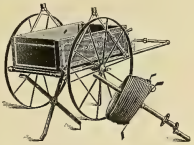


Boston Cable Clip.

Two pieces steel wire and a piece of zinc.

The simplest and strongest. Easy and quick to adjust, and stays.





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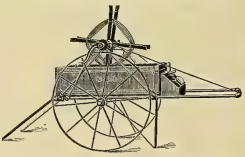
All iron and steel, except the box. Carries wire, tools and everything necessary. A regular commissary department.



The American Grip.

(PATENTED.)

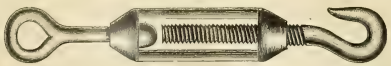
THE CROSBY WIRE ROPE CLIP.

Central Galvanized Grip.

A Line of Grips.

Galvanized Guy Rods.

5/8-inch diameter, any length.



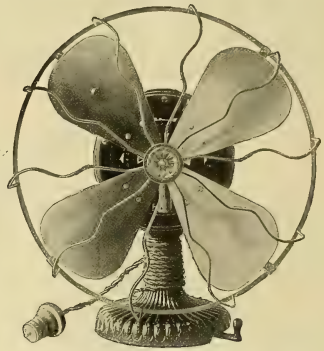
All sizes and styles in Chicago stock. Double Eye—Hook and Eye—Double Hook. Japanned or galvanized.

Galvanized Guy Cable.

7 Strand—1/4 to 1/2, carried in Chicago stock.

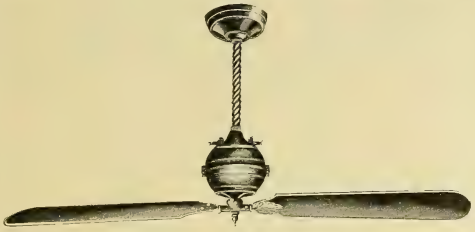
ATMOSPHERIC ACCELERATORS.

Westinghouse Alternating Fan Motors.



50 and 100 Volts. 7200-1600 Alternations.
13 Inch Blades.

IN CHICAGO STOCK.



SENIOR CEILING FAN MOTOR.

The Senior Ceiling Fan Motor

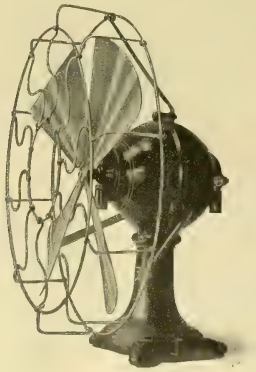
is the only motor suitable for continuous operation on 500 volt circuits.

Lundell Direct Current Fan Motors

12 INCH AND 16 INCH

Desk and Bracket.

GET OUR LATEST PRICES.



CENTRAL ELECTRIC COMPANY,

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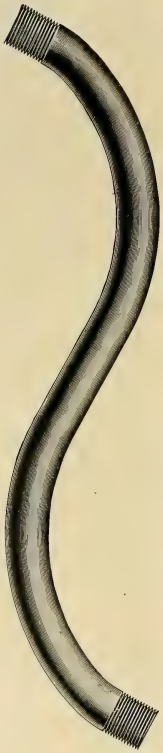
CHARLES E. BROWN, Secretary.
S. R. FRAZIER, Treasurer.

264, 266, 268, 270 Fifth Avenue,
.....CHICAGO.

IRON ARMORED INTERIOR CONDUIT.

Introduced and standardized by Interior Conduit and Insulation Company.



NEW PRICES.

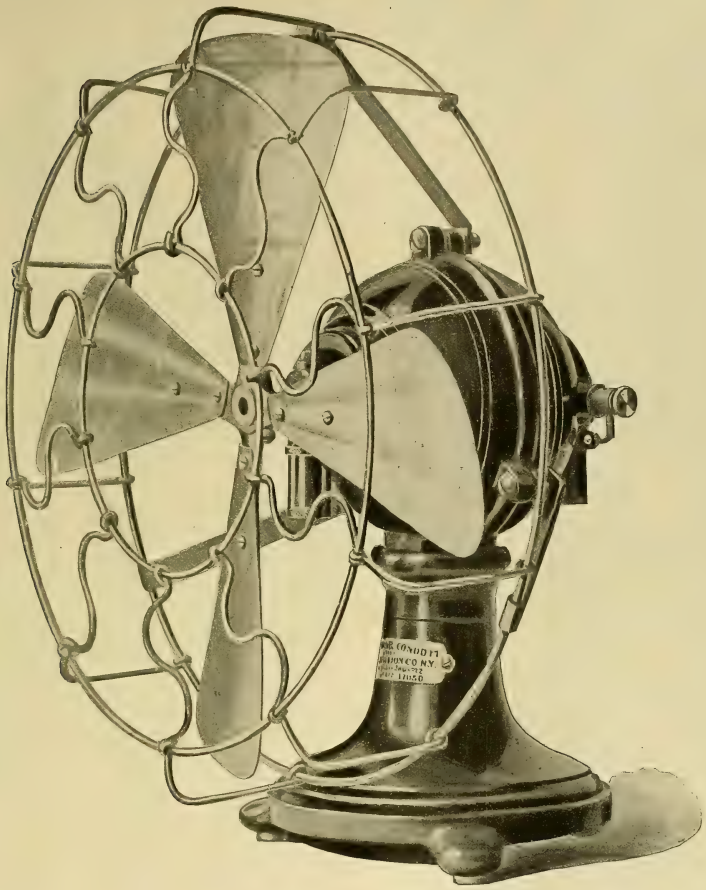
UNEQUALLED PRODUCT.

This conduit has earned for itself the favor of the U. S. Government, Insurance Experts and thousands of builders all over the country.

The only conduit which has proved its worth during years of practical use. Competitive tests have only emphasized its superiority.

SPRAGUE ELECTRIC COMPANY,

CHICAGO---Marquette Bldg. **NEW YORK CITY---20 Broad St.**

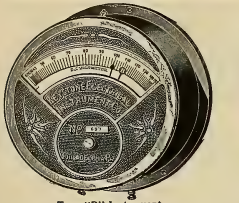


1898 **Lundell Fan Motors.** 1898

Advance orders, greatest in the history of the business, attest the popularity of these motors. They are the world's standard. '98 styles are—some of them—new. '98 prices are lower than ever. Catalogue—second edition—just out.

SPRAGUE ELECTRIC COMPANY,

CHICAGO—Marquette Building. NEW YORK—20 Broad Street.



Type "R" Instrument.

Keystone Electrical Instrument Co.

Switchboard Voltmeters, Ammeters, Ground Detectors and Differential Voltmeters.

We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

Our instruments are constant and durable, sensitive and accurate, pleasing in appearance and always correct.

We can interest you in prices and other details if you will write to

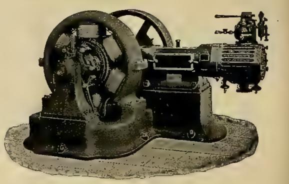
Ninth Street and Montgomery Avenue, Philadelphia.
New York, 15 Cortlandt Street.
Chicago, 414 Ashland Block.

THE AKRON ELECTRICAL MFG. CO.,

AKRON, OHIO.

MAKES

Generators, Motors, Direct-Connected, Slow Speed, Moderate Speed, Mining Locomotives.



All of the highest efficiency, most modern construction and most graceful design.

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Electric Appliance Co.
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Ohio Elec Specialty Mfg. Co.
Pacific Electric Co.

Electro-Magnets.
Varley Duplex-Magnet Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.
Hobart Elec. Mfg. Co.

Engines, Gas.
Otto Gas Engine Wks.
Wolverine Motor Works.
Wray Co., John C. Co.

Engines, Steam.
American Engine Co.
Ames Iron Works.
Armington & Sims Co.
Ball Engine Co.
Bullock M. C. Mfg Co.
Skinner Engine Co.
Westinghouse, Church, Kerr & Co.
Wray Co., John C. Co.

Fan Outfits.
Bates & Bro., D. L.
Carlisle & Finch Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
General Electric Co.
Illinois Electric Co.
Marietta Mfg. Co.
Rosenberg Co., A.
St. Louis El. Supply Co.
Schneider Mfg. Co.
Specialty Mfg. Co.
Sprague Electric Co.
Wagner Electric Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Delaware Hard Fibre Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Fixtures, El. & Comb'n.
Central Electric Co.
Commercial El. Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuse Wire.
Central Electric Co.
Chi. Fuse Wire & Mfg. Co.
Commercial El. Supply Co.
Electric Appliance Co.

Gaskets.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

Gas Lighting, Electric.
Central Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co.

Gears.
Besly & Co., Chas. H.
Link-Belt Machinery Co.

General Elec. Supplies.
Ansonia Electrical Co
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
Hill, W. S. Electric Co.
Illinois Electric Co.
Partrick, Carter & Wilkins.
Peru Elec. Mfg. Co.
St. Louis El. Supply Co.
Western Electric Co.

Globes and Electrical Glassware.
Central Electric Co.
Commercial El. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Hanger Boards.
K. & W. Company.

Insulators and Insulating Materials.
Akron Ins & Marble Co.
Ansonia Electrical Co.
Atlantic Alcatraz Asph. Co.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Illinois Electric Co.
Kartavert Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Western Electric Co.

Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Montauk Multiph. Cable Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.

Junction Boxes.
Bossert Elec. Const. Co.
Leonard, H. Ward Elec. Co.

Lamp Adjusters.
Faries Mfg. Co.

Lamps, Incandescent.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Commercial El. Supply Co.
Electric Appliance Co.
Fostoria Inc. Lamp Co.
General Electric Co.,
Illinois Electric Co.
K. & W. Company.
Lynn Incandescent Lp. Co.
Pond Electric Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Stillwell-Bierce Smith-Vaile.
Westinghouse, Church, Kerr & Co.

Mica.
Central Electric Co.
Commercial El. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
Schoonmaker, A. O.

Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.

Motors.
Akron Elec. Mfg. Co.
American Engine Co.
Belknap Motor Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Illinois Electric Co.
Northern Electl. Mfg. Co.
Sargent & Lundy.
Sprague Electric Co.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wray Co., John C.

Name Plates.
Becker, August.

Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

Paints.
Atlantic Alcatraz Asph. Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.

Poles.
Baily Mfg. Co.
Berthold & Jennings.
Central Mfg. Co.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pine Company.
Perriso & Sons.
Pittsb. & L. Sup. Iron Co.
Stone Lumber Co.
Torrey Cedar Co.
Valentine-Clark Co.

Porcelain.
Akron Ins. & Marble Co.
Central Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.

Refiners.
Goldsmith Bros.
Swarts Metal Refining Co.

Re-Winding—Repairs.
Chicago Armature Co.
Chicago Edison Co.
Hodge, Walsh & Loring.
Morrell Electric Works.

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American Rheostat Co.
Automatic Switch Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Leonard, Ward, Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.

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Cincinnati Corrugating Co.

Second-Hand Machin'y.
Cornman Co.
Electrical Exchange.
Hine & Co., L. A.
Hodge, Walsh & Loring.

Shades.
Faries Mfg. Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Illinois Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co

Speed Indicators.
Besly & Co., Chas. H.
Keystone El. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
High Tension El. Stor. Co.
Lockie & Viall.

Street Cars.
Stephenson Co., John.

Tapes, Insulating.
American Electrical Works
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Boardman-Tucker Co.
Cabinet Mfg. Co.
Commercial El. Supply Co.
Ericsson Telephone Co.
Farr Tel. & Cons. Sup. Co.
Holtzer-Cabot Electric Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co.
Mason Tel. Pay Station Co.
Northwest Engineering Co
Penn. Electric Co.
Rawson Electric Co.
St. Louis El. Supply Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tl. M. Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Cons. Co.
Wilhelm Tel. Mfg. Co.

Tools.
Klein & Son, Mathias.

Transformers.
Central Electric Co.
Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co

Trolley Cord.
Samson Cordage Wks.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Stilwell-Bierce Smith-Vaile.

Universities.
Rose Polytechnic Inst.
Worcester Polytechnic Inst.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
Western Electric Co.

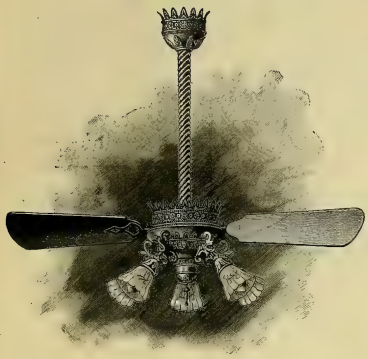
Woodwork, Electrical.
Cabinet Mfg. Co.

X Ray Outfits.
Central Electric Co.
Commercial El. Supply Co
Queen & Co.

For Alphabetical Index of Advertisements See Page III.

DIEHL FANS

FOR ALL CIRCUITS, EXCEPT ALTERNATING.



OUR CEILING FANS AND ELECTROLIERS
ARE THE

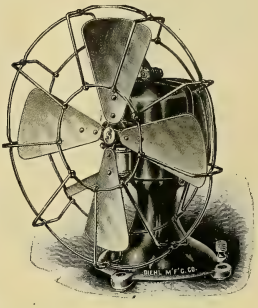
Recognized Standard

OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency

Of Any on the Market.



WRITE FOR CIRCULARS AND PRICES
ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway.
CHICAGO: 192-194 Van Buren St.
BOSTON: 128-132 Essex St.

DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

INCANDESCENT LAMPS 12 cents.

Now is the time to get your burned out lamps together and have them renewed or turned into cash. We have now repaired over 700,000 lamps, and nine out of ten of our shipments are to old customers.

We use the same care as regards voltage, candle power, etc., as in making our new lamps.

We are now pleasing central station managers by supplying a uniform and efficient lamp at a price that makes it profitable to replace lamps every 600 hours or oftener.

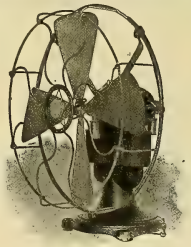
The renewal of lamps makes this possible.

If you prefer new lamps, we can supply you with the best and allow you three cents each for your burned out lamps.

Lynn Incandescent Lamp Co.,
LYNN, MASS.

MANUFACTURERS OF DESK,
Bracket, Column and Ceiling Fan Motors.

W. E. 1898 FAN



W. E. 1898. 12-in. Desk Fan Motor.

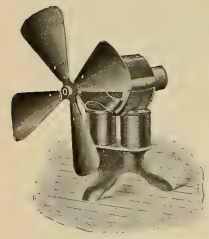
MOTORS,

Made for 110, 220 and 500 volts. Every motor tested at twice its rated voltage.
Every motor guaranteed.
Efficient and Durable.
Ceiling Fans, Column Fans, Desk Fans, Bracket Fans.

Send for Catalog.
Complete description of fans, with illustrations.

Western Electric Co.,
CHICAGO. NEW YORK.

THE HYDRO-ELECTRIC FAN!

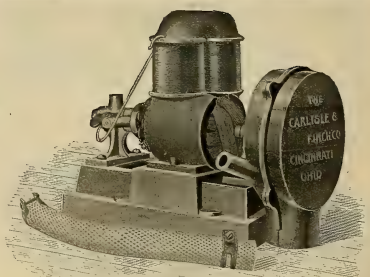


SOMETHING NEW.

Will Run on 40 Pounds Water Pressure or Over.

SPEED OF FAN 1800.

WRITE FOR CIRCULAR "C."



The Carlisle & Finch Co.,

832 West 6th Street,

CINCINNATI, OHIO.

THE "AMERICA."
Patent allowed 1898.

THE only Water Motor that can be adjusted or tilted in any direction while running. Ordinary house supply at 30 lbs. pressure will drive fan, sewing machine, dental engine or dynamo, etc. Motor 7 inches diameter will run over 2,000 revolutions per minute with 50 to 60 lbs. pressure.

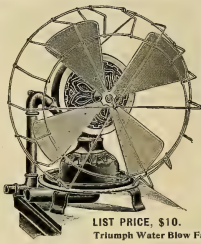
Price with pulley and brass balance wheel, $13.50 cash; with 12-inch polished brass fan and guard, $14.40 cash. Agents wanted.

A. ROSENBERG CO.

Office, 629 N. Carey Street, Baltimore, Md., U. S. A.

State Water Pressure.

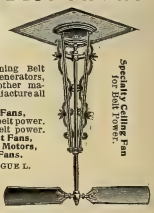
THE ELECTRICIAN'S BEST FRIEND.



Our Fans and Motors are in your line. You sell them and get a new customer. Our Water Motors are the most powerful and are used for running Belt Fans, Telephone Generators, Coffee Mills and other machinery. We manufacture all kinds of fans.

Triumph Water Fans.
Ceiling Fans for belt power.
Floor Fans for belt power.
Triumph Exhaust Fans,
Specialty Water Motors,
Electric Ceiling Fans.

SEND FOR CATALOGUE L.



SPECIALTY MFG. COMPANY,

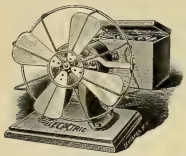
361 TO 367 S. MERIDIAN STREET,

INDIANAPOLIS, IND.

LIST PRICE, $10.

Triumph Water Blow Fan. (Pat. applied for.)

COOL HEADED



Dealers buy our outfits

BECAUSE

they give satisfaction and are easily sold.

Complete with cabinet, connecting cords, etc.

150 HOURS

before renewing the battery.

6 in., 8 in. and 10 in. Fans, 1898 models.

Write for Circulars.

KNAPP MOTORS.
GORDON CELLS.

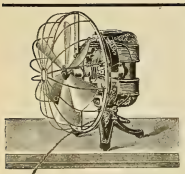
Gordon-Burnham Battery Co.,

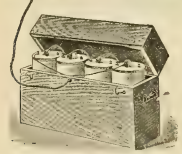
Department 3. 594 BROADWAY, NEW YORK.

Motors-Dynamos

NORTHERN ELECTRICAL MFG. CO.,

Chicago Office, 1602 Monadnock. MADISON, WIS.





Edison 9-inch Battery Fan Outfit.....

MOTOR WITH BALL BEARINGS.

The most economical and efficient battery fan motor on the market.

WRITE FOR CATALOGUE.

EDISON MFG. COMPANY,

THOS. A. EDISON, Proprietor.

FACTORY: ORANGE, N. J.

St. James Building, Broadway and 26th Street, NEW YORK.

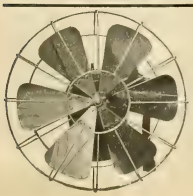
A HOT TIME OUT OF THE QUESTION

BATES ELECTRIC FANS DO IT

Wound for any Voltage Direct or Alternating.

D. L. BATES & BRO. DAYTON, O.

For Ceiling or Desk A Written Guarantee with each FAN.



The Gem Water Motor Fan.

Novel in Construction.
As Easily Installed as an Electric Fan Motor.
Discounts for Exclusive Agents. Correspondence Solicited.

Simple, Effective,
Economical, Noiseless.
List Price, $10.00.

JUST THE THING FOR SUPPLY HOUSES TO CARRY.

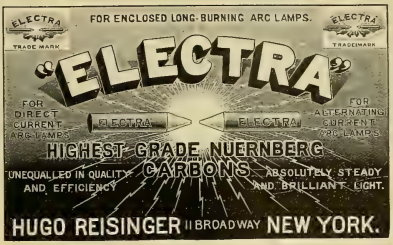
Agents Wanted.

THE SCHNEIDER MFG. CO., 1139 Hamilton Street, CLEVELAND, OHIO.

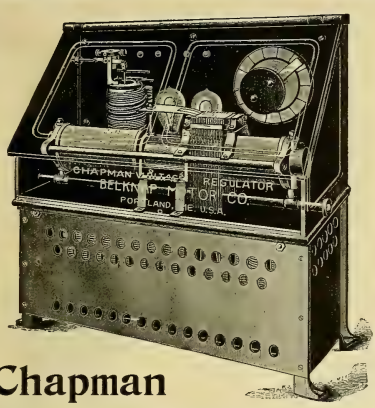
McGILL & POMEROY, 321 Dearborn St., Chicago, Ill., Agents for Indiana, Illinois, Missouri, Iowa, Wisconsin, Michigan.

All genuine "ELECTRA" Carbons are put up in packages bearing a label with the TRADE MARK "ELECTRA."

Infringers of my trade-mark will be rigidly prosecuted to protect the interest of purchasers of my carbons.



Notice—The "ELECTRA" Highest Grade Nuernberg Carbons are, as heretofore, manufactured for me by the world-renowned firm of **C. Conradty, of Nuernberg,** who owns both the oldest as well as the **largest carbon works in existence,** and whose carbons are recognized as the standard all the world over.



Chapman Voltage Regulators

insure **Steady Light** from unsteady power.
For use with Steam or Water Plants.

—No Attendance Required.—

Regulator sent on 30 days' trial.
Let us show what it can do for you.

Belknap Motor Company,

474-478 Fore Street, PORTLAND, MAINE, U. S. A.

New York Office, 27 Thames Street. Boston Office, 620 Atlantic Ave.

ILLINOIS ELECTRIC COMPANY,

239 MADISON STREET, CHICAGO, ILL.

We carry a Complete Line of Electrical Supplies of Every Description
We are agents for the

N. I. R. RUBBER COVERED WIRES AND CABLES, CREFELD ELECTRICAL WORKS WEATHERPROOF, MAGNET, OFFICE AND ANNUNCIATOR WIRES, EDISON, JR., INCANDESCENT LAMPS, LUNDELL FAN MOTORS. Write us for prices.

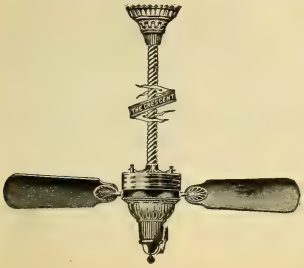
The American Electric Meter Co.,

9th St. and Montgomery Ave., Philadelphia, Pa.,

Is now prepared to take orders for early delivery of all sizes of 3-Wire Constant Potential Registering Meters.

This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
This meter is hermetically sealed.
This meter measures correctly with uneven loads.
This meter can be calibrated with a watch in six minutes.
This meter requires no lubrication.
This meter is magnetically shielded.
This meter is direct reading, having no multiplier.
This meter does not require one-thousandth of a horse power.
This meter will operate for years without opening.
This meter has no springs, jewels or frictional errors.
This meter once right is always right.

IF YOU WANT AN ARTICLE OF MERIT



BUY THE CRESCENT.

Wound for Any Voltage.

DIRECT CURRENT.

WRITE FOR PARTICULARS.

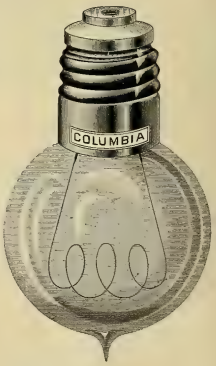
Marietta Manufacturing Company,
MARIETTA, PA.

COLUMBIA LAMPS

UNEQUALED IN QUALITY.

We solicit the business of central stations and isolated plants on the claims for superiority of Columbia Lamps which we are prepared to carry out in actual service.

The filaments used in our product are made in our own factory under our own supervision; and the detail followed in every department of the factory, and the care used in the proper selection of lamps, makes it possible for us to guarantee Columbia Lamps absolutely uniform in every respect.



Send us a trial order and be convinced that our claims are well founded.

Special prices on annual contracts where requirements equal or exceed 1,000 lamps.

Prompt shipments from factory and branch offices.

The Columbia Incandescent Lamp Company,

Main Office and Factory: 1910, 1912, 1914 Olive Street, St. Louis, Mo.

New York Office: 1311 Havemeyer Bldg. Chicago Office: 1236 Monadnock Bldg.

San Francisco: Paul Seiler Electrical Works.

PLATES 2 x 3½ Handsomely Engraved in Raised Letter, bronzed or nickeled, $10 per 100. Other Sizes at Equally Low Rates.

August Becker
NAME PLATES

34 OLIVER & 256 FRANKLIN STS.
BOSTON, MASS.

Engraver On All Kinds of Metals. Designs and Estimates furnished on application For Dynamos, Motors and Switchboards.

Incandescent Electric Light Manipulator.

MOST incandescent lights in large buildings are at such heights and angles that it is necessary to use large ladders, which take a couple of men to handle and considerable time, and also the liability of chipping stucco work and scratching interior finish. The device here described one man can operate, keep burnt-out lights replaced, clean the same, and thereby receive the full benefit of the power you pay for. The device is mechanically built to last, and all parts can be duplicated. The nippers are made to fit the incandescent bulb, and are lined with RUBBER. Will get a good grip and will not break bulb. A toggle action, connected with nippers by a braided cord, and carried down through centre of springs and inner tubing, and made fast to a ratchet lever, the turning of which tightens nippers on bulb and releases the same when replacing or cleaning the lights. The outer cord, shown in cut, or a set screw, sets the spring to correspond with the position the light may be in chandelier or wall socket. This angle arrangement works on three sliding ferrules, or round bands, affixed to spring and tube. The turning of pole in operator's hands will unscrew the burnt-out lamp from socket and replace same.

The device is used by the Edison Electric Light Co., State House, Trinity Church, Mission Church, McKenney, Waterbury, Pettingill-Andrews, Department of Public Grounds, Hall, Downing, Stowe Co., N. Y. Athletic Club, Post-Glover Electric Co., Corre Hotel Co., Cinn., Western Electric Co., Chicago, J. Laffargne, Paris.

Send the length of pole desired, reach of your lights, and the shape and candle power, and I will quote you price.

All goods nickel-plated. Special prices quoted. ☞Agents wanted.

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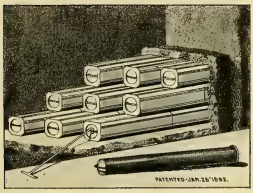

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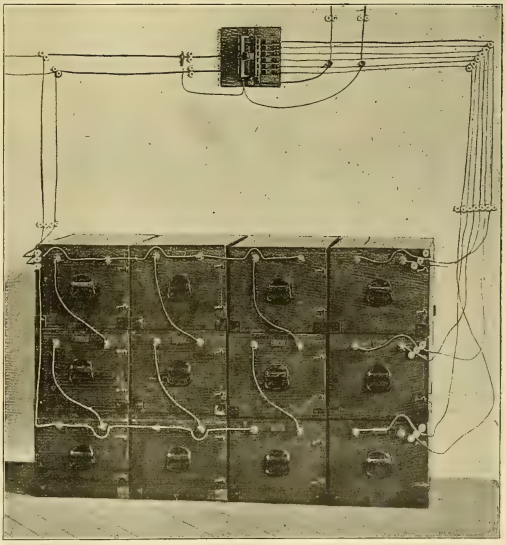

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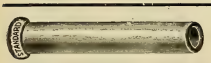

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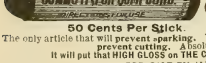

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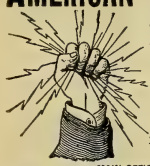

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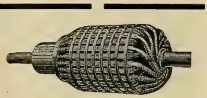

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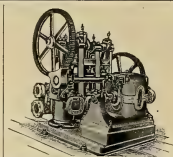

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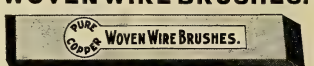

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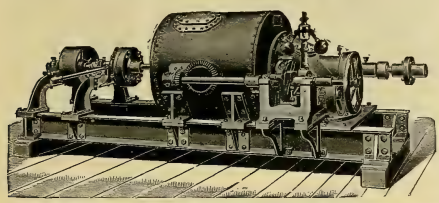

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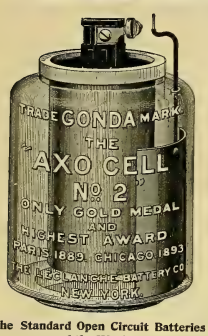

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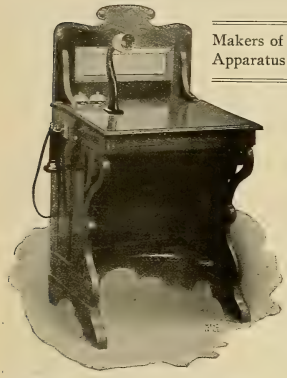

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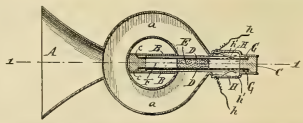

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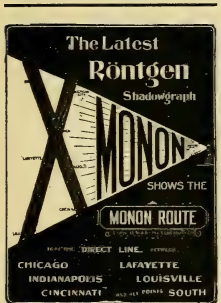

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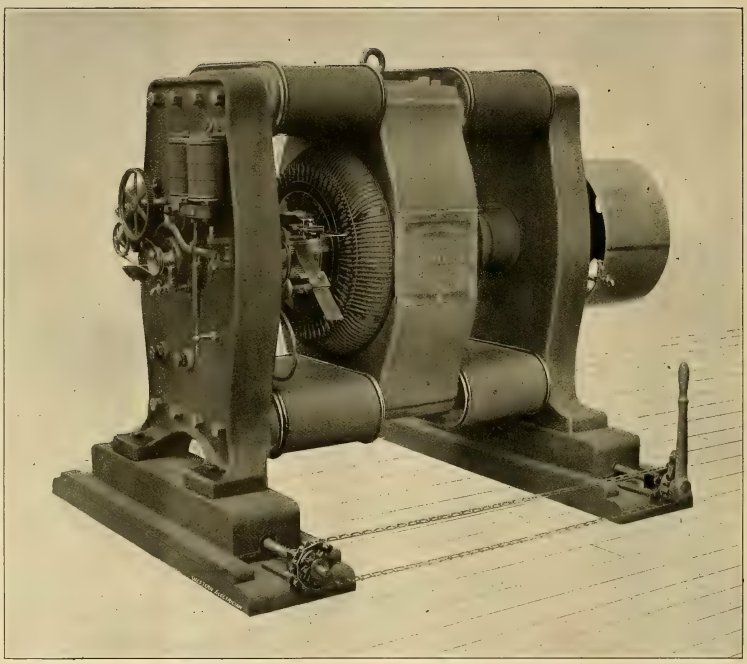

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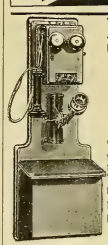

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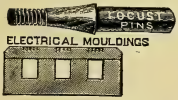

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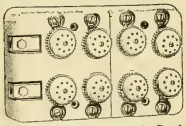

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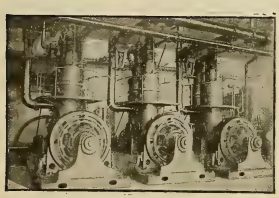

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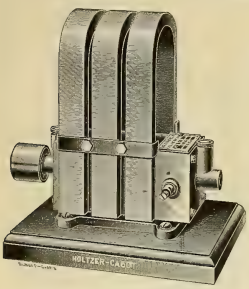

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CONTENTS: Introductory.—Percentage of Patents Sustained.—Supreme Court Decisions.—Berliner Case.—Induction Coil.—Drawbaugh Cases.—Hunnings Transmitter.—Subscribers' Calls.—Switchboards.—Law System.—Main System.—Multiple Board.—Express System.—Ravenel-Hess System.—Comparative Advantages: Multiple and Divided Board Systems.—Carney Plug Board.—Brief Mention.—Automatic Switchboards.—Conclusions.—Index.

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Patent of A. G. Bell, No. 174,465. Patent of Emile Berliner, No. 233,969. Patent of Emile Berliner, No. 463,569. Patents of Emile Berliner in Parallel Columns. Patent of C. A. Cheever, No. 208,463. Patent of H. H. Eldred, No. 260,714. Patent of Thos. A. Watson, No. 256,258. Patent of L. B. Firman, No. 283,231. Patent of M. G. Kellogg, No. 247,196. Patent of C. E. Scribner, No. 239,058. Patent of C. E. Scribner, No. 260,154. Trunking Principle. Patent of Shaw & Childs, No. 319,856. Main System. Patent of L. B. Firman, No. 282,576. Western Union Pin Switch. Express System. Patent of Sabin & Hampton, No. 513,534. Subscriber's Automatic Signal. Ravenel-Hess System. Patent of M. J. Carney, No. 258,886. Apostoloff System.

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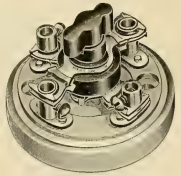

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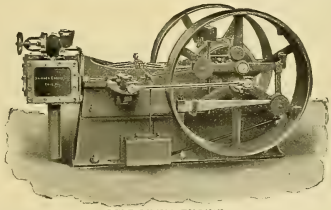

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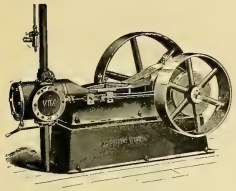

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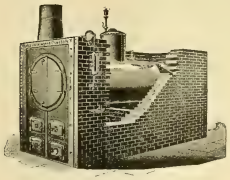

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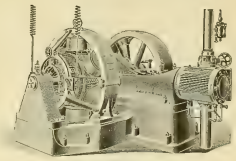

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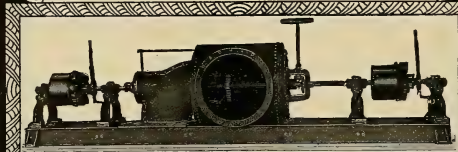

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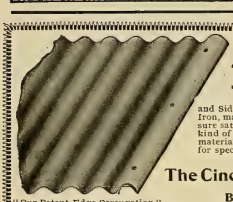

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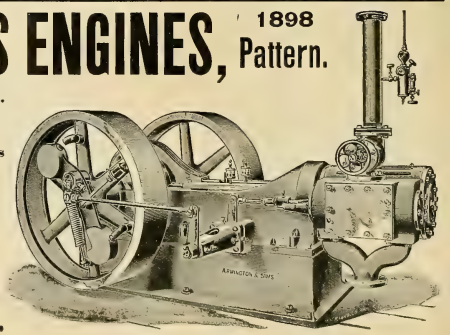

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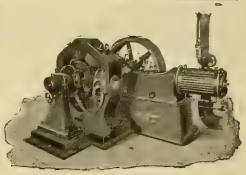

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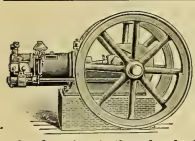

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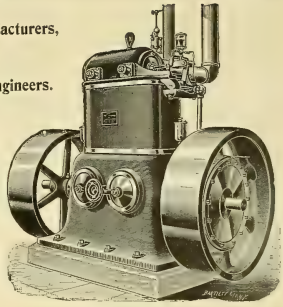

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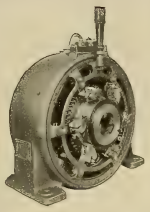

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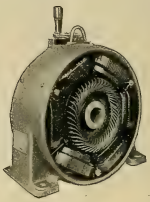

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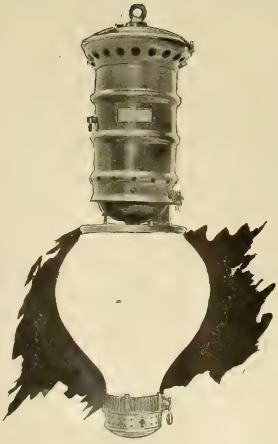

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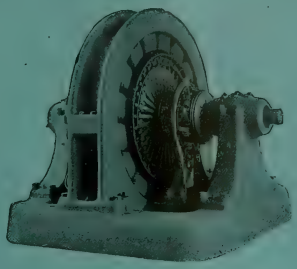

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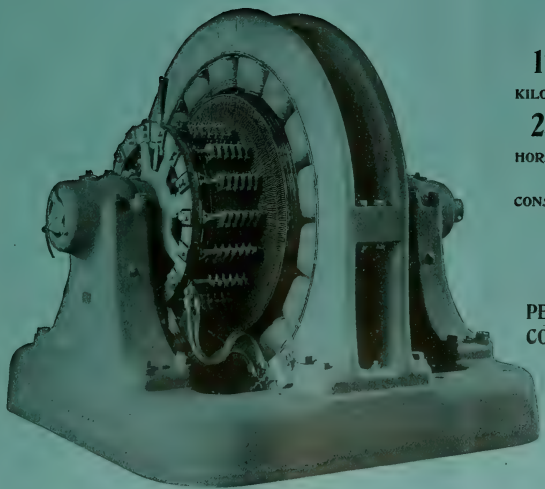

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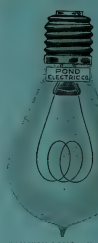

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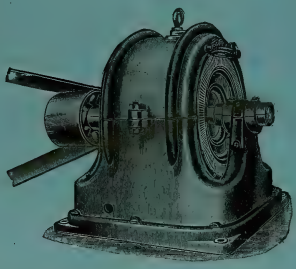

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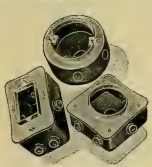

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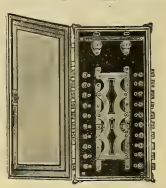

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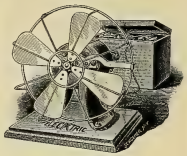

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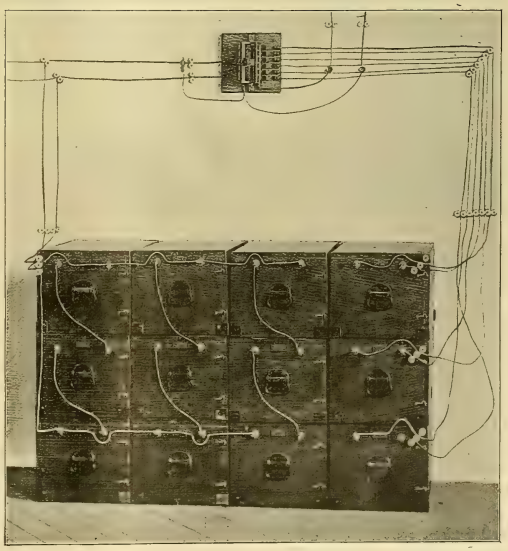

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Walker Company.
Western Electric Co.

Contractors and Electric Light Plants.
Akron Elec. Mfg. Co.
Bain, Peter.
Broughton, H. P.
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
McRae, A. L.
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Sargent & Lundy.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Mfg. Co.
Western Electric Co.
Westinghouse Elec & Mfg Co.

Conveyors.
Link-Belt Machinery Co.

Copper.
Beely & Co., Chas. H.
Jersey Electric Co.
Mansfield Temp. Copper Co.
Mitchell Temp. Copper Co.

Copper Wires.
American Electrical Works.
Beely & Co., Chas H.
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General Electric Co.
Illinois Electric Co.
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Okonite Co., The.
Phillips Insulated Wire Co
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Electric Appliance Co.
Emerson El. Mfg. Co.
General Elec. Co.
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K. & W. Company.
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Paiste Co., H. T.
Peru Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
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General Electric Co.
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Fuel Economizer Co.

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American El. Meter Co.
Zamel Arc Light Meter Co.

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Sprague Electric Co.
Walker Company.
Westinghouse El. & Mfg. Co.

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Lemon, G. E.
McRae, A. L.
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Pacific Electric Co.

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Vacuum Supply Magnet Co.

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General Electric Co.
Hobart Elec. Mfg. Co.

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Wolverine Motor Works.
Wray Co., John C. Co.

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Ames Iron Works.
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Wray Co., John C. Co.

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Illinois Electric Co.
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Specialty Mfg. Co.
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Wagner Electric Mfg. Co.
Walker Company.
Western Electric Co.
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Karlavern Fibre Co.
Vulcanized Fibre Co.

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Barnett Co., G. & H.

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Commercial El. Supply Co.

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Stow Mfg. Co.

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Chi. Fuse Wire & Mfg. Co.
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Peerless Rubber Mfg. Co.

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Western Electric Co.

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Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
Hill, W. S. Electric Co.
Illinois Electric Co.
Partrick, Carter & Wilkins
Peru Elec. Mfg. Co.
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Lombard Water Wheel Gv.Co.

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Holmes Fibre-Graphite Co.

Hanger Boards.
K. & W. Company.

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Akron Ins. & Marble Co.
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Atlantic Alcatraz Asph. Co.
Brixey, W. K.
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Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Illinois Electric Co.
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Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
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Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
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American Electrical Works.
Brixey, W. K.
Central Electric Co.
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Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
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Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
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General Electric Co.
Illinois Electric Co.
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Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

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Westinghouse, Church, Kerr & Co.

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Commercial El. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
Schoonmaker, A. O.

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General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.

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American Engine Co.
Belknap Motor Co.
Bullock Elec. Mfg. Co.
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Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
Illinois Electric Co.
Northern Electl. Mfg. Co.
Sargent & Lundy.
Sprague Electric Co.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wray Co., John C.

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Becker, August.

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Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

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Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
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Beely & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

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Baker & Co.

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Hodge, Walsh & Loring.

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Faries Mfg. Co.

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Partrick, Carter & Wilkins.
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Electric Storage Battery Co.
High Tension El. Stor. Co.
Lockie & Niall.

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Stephenson Co., John.

Tapes, Insulating.
American Electrical Works.
Brixey, W. K.
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Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.

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Keystone Tel. Co.
Kokomo Tel. & Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co.
Mason Tel. Pay Station Co.
Northwest Engineering Co.
Penn Electric Co.
Rawson Electric Co.
St. Louis El. Supply Co.
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Sterling Electric Co
Stromberg-Carlson Tl. M. Co
Viaduct Mfg. Co.
Western Electric Co.
Western Cons. Co.
Wilhelm Tel. Mfg. Co

Tools.
Klein & Son, Mathias.

Transformers.
Central Electric Co.
Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
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Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co

Trolley Cord.
Samson Cordage Wks.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Dayton Globe Iron Works Co
Leffel & Co., J.
Pelton Water Wheel Co.
Stilwell-Bierce Smith-Vaile

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Worcester Polytechnic Inst.

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Vulcanized Fibre Co.

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Brixey, W. K.
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Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co.
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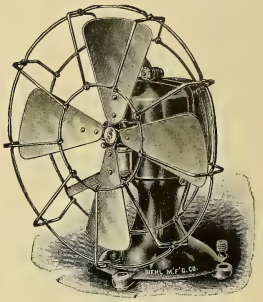
FOR ALL CIRCUITS, EXCEPT ALTERNATING.

OUR CEILING FANS AND ELECTROLIERS
ARE THE

Recognized Standard
OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency
Of Any on the Market.



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ELIZABETHPORT, N. J.

WE MANUFACTURE **ARC LAMPS FOR ALL CIRCUITS.**

Constant Potential Enclosed for 110 v.
C. P. Series Enclosed for 500 v. R. R. Alternating Open Arc.
Constant Potential Series Open Arc.
Constant Current Series Enclosed.
C. P. Series Enclosed for 220 v.
Series Differential Open Arc.

OUR "A-B" METAL HANGER BOARD IS ACKNOWLEDGED "THE BEST" ON THE MARKET.

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The Best System of Belting in the World

The G L P & D Transmitter
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Compared with Straight Belts - - { Easier on bearings, Smaller per cent. of slip, One-half the space.
Compared with Clutches - - - - { Less expense, More efficient in operation, Great saving in space.
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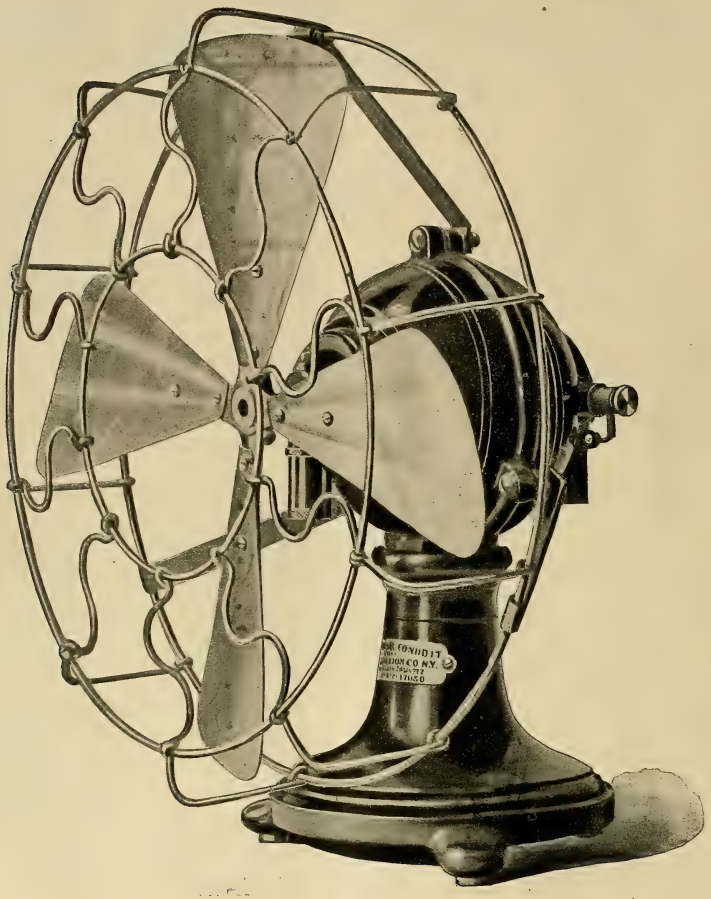

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Advance orders, greatest in the history of the business, attest the popularity of these motors. They are the world's standard. '98 styles are—some of them—new. '98 prices are lower than ever. Catalogue—second edition—just out.

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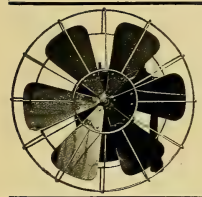
Engraver On All Kinds of Metals. Designs and Estimates furnished on application For Dynamos, Motors and Switchboards.



The Gem Water Motor Fan.

Novel in Construction. As Easily Installed as an Electric Fan Motor. Simple, Economical, Effective, Noiseless.
Discounts for Exclusive Agents. Correspondence Solicited. List Price, $10.00.

JUST THE THING FOR SUPPLY HOUSES TO CARRY.
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THE "AMERICA." Patent allowed 1898.

THE only Water Motor that can be adjusted or tilted in any direction while running. Ordinary house supply at 30 lbs. pressure will drive fan, sewing machine, dental engine or dynamo, etc. Motor 7 inches diameter will run over 2,000 revolutions per minute with 50 to 60 lbs. pressure. Price with pulley and brass balance wheel, $13.50 cash; with 12-inch polished brass fan and guard, $14.40 cash. Agents wanted.

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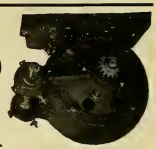

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State Water Pressure.

THE ELECTRICIAN'S BEST FRIEND.

Our Fans and Motors are in your line. You sell them and get a new customer. Our Water Motors are the most powerful and are used for running Belt Fans, Telephone Generators, Coffee Mills and other machinery. We manufacture all kinds of fans.

Triumph Water Fans, Ceiling Fans for belt power. **Floor Fans** for belt power. **Triumph Exhaust Fans, Specialty Water Motors, Electric Ceiling Fans.**

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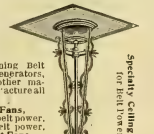

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LIST PRICE, $10.
Triumph Water Blow Fan. (Pat. applied for.)

MANUFACTURERS OF DESK, Bracket, Column and Ceiling Fan Motors.

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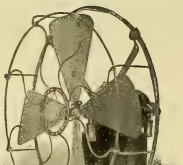

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Made for 110, 220 and 500 volts. Every motor tested at twice its rated voltage.
Every motor guaranteed.
Efficient and Durable.
Ceiling Fans, Column Fans, Desk Fans, Bracket Fans.

Send for Catalog.
Complete description of fans, with illustrations.

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Edison 9-inch Battery Fan Outfit.....

MOTOR WITH BALL BEARINGS.

The most economical and efficient battery fan motor on the market.

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Still lead all others

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Multipolar **Electroplating Dynamos**—Best on the Market. Special **Motors** and Automatic **Controllers** for **Pump** and **Elevator** Equipment.

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QUALITY UNEQUALED
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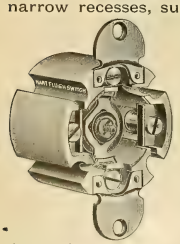
BEST and CHEAPEST.

As here illustrated, we make Flush Switches with both Round and Rectangular Bases. Our ROUND style Base will fit our regular Iron Frames and Boxes. Our RECTANGULAR Bases are adapted for narrow recesses, such as Frames and Boxes usually used for "Push Button" Flush Switches. You will therefore note that if some other style of Flush Switch which you have in use causes trouble, you can replace it with a



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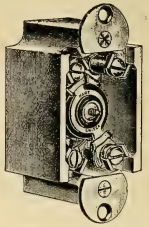
without disturbing your own frame or box. Simply take out the defective Switch and replace it with a HART.

For full particulars, see our Illustrated Catalogue, pages 14 and 28.

All Electrical Supply Houses carry these Switches in stock, and can fill orders without delay.



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Make your orders read "HART" Switches, and you will be well satisfied with value received.

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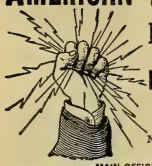
PROVIDENCE, R. I.



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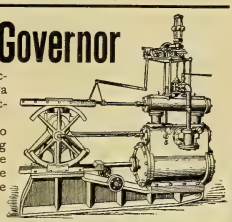

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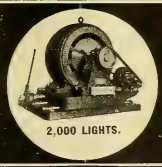

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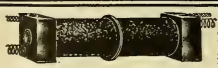

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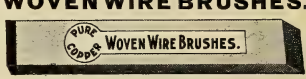

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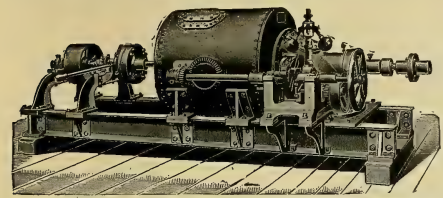

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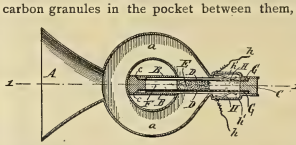

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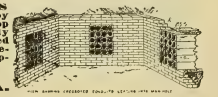

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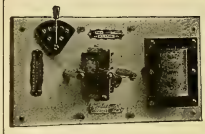

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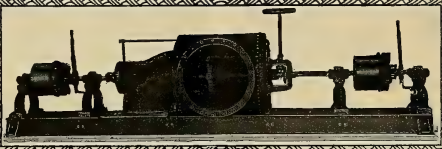

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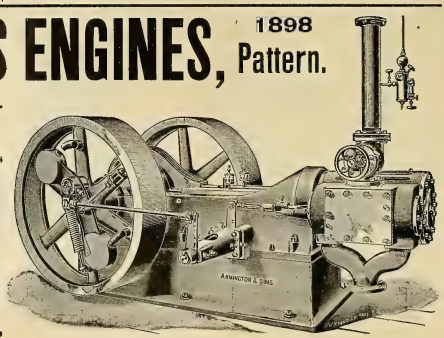

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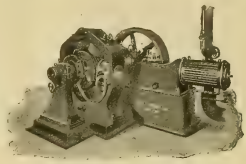

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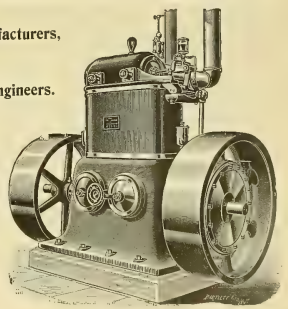

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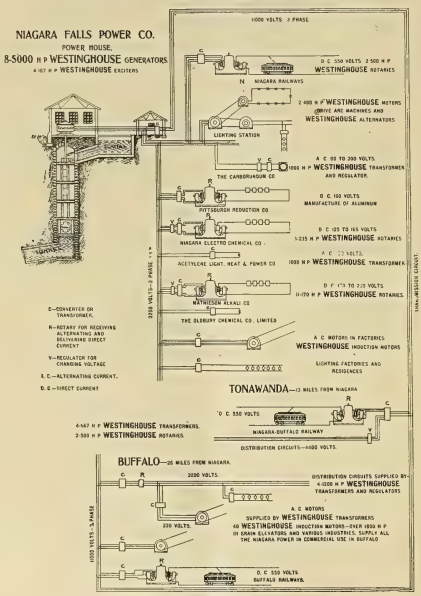

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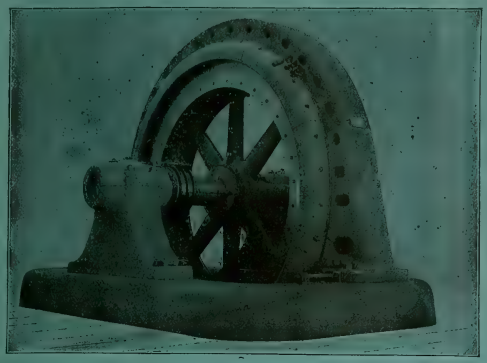

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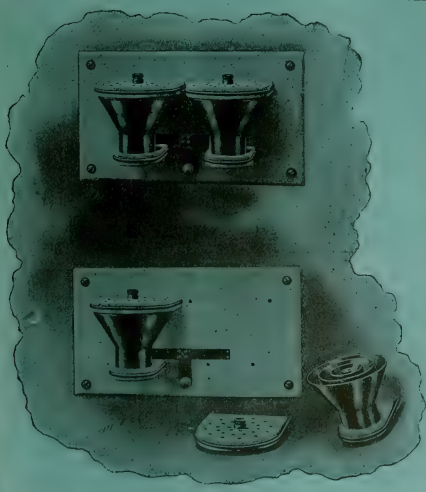

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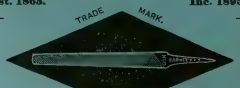

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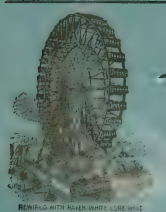

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